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USSR Report

PHYSICS AND MATHEMATICS

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ACOUSTICS

UDC 534.232.535.3

RADIATION-COLLISION SOUND SOURCE

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 3, Mar 84
(manuscript received 15 Apr 83) pp 510-519

GEL'MUKHANOV, F. Kh., Institute of Automation and Electrometry, Siberian Department, USSR Academy of Sciences

[Abstract] The generation of sound based on the light-induced draft phenomenon is investigated within the framework of a thirteen-moment Grad approximation. Kinetic equations are derived that describe the interaction of radiation with a gas in field-linear approximation. The acoustic oscillations are found to be quasistationary microscopically. The generation of sound in a gas enclosed in a cylindrical resonator and in a radiation-collision antenna is investigated. A mechanism underlying sound generation is proposed in which the vibration amplitude is a function of the sign of the mismatch, making it possible to eliminate the sound masking the thermal excitation effect. References 10: 9 Russian, 1 Western.
[300-6900]

UDC 535.338.3:621.378.3

CHARACTERISTICS OF IMPULSE ACOUSTOOPTICAL EFFECT IN GASES

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 2, Feb 84
(manuscript received 16 Feb 83) pp 342-347

VERESHCHAGINA, L. N., ZHAROV, V. P., SHIPOV, G. I. and SHTEPA, V. I., Moscow State University imeni M. V. Lomonosov

[Abstract] A rigorous solution is found for the problem of the formation of pulsed acoustooptical signals in the chamber of a gas measurement cell. A theoretical model of the gas cell is constructed, and it is shown that two types of acoustooptical signals are formed simultaneously due to thermodynamic heating of the gas and the resonant acoustic properties of the medium in the cell. Simple methods are proposed for extracting one type of signal alone. References 8: 7 Russian, 1 Western.
[288-6900]

DETERMINATION OF FREQUENCY CHARACTERISTICS OF IMPEDANCE OF THREE-DIMENSIONAL ACOUSTIC ELEMENTS BY GEOMETRIC CONSTRUCTION METHOD

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR: SERIYA TEKHNICHESKIKH NAUK in Russian Vol 37, No 1, Jan-Feb 84 (manuscript received 28 Oct 83) pp 20-24

BORISOV, L. A. and GASPARYAN, Yu. A., Yerevan Polytechnical Institute imeni K. Marx

[Abstract] A method is proposed for determining the input impedance of a nonspherical three-dimensional element in which measurements are taken for a narrow range of frequencies and the impedance frequency response is then constructed throughout the entire frequency range. It is demonstrated possible to use geometric impedance constructions to analyze the acoustic absorption characteristics of a broad class of three-dimensional elements with complex structures. References 3 Russian.
[280-6900]

SURFACE ACOUSTIC WAVE ATTENUATION IN PIEZOELECTRICS DURING INTERACTION WITH PLASMA GAS DISCHARGE

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 6, 26 Mar 84 (manuscript received 11 Jan 84) pp 371-374

DOBROVOL'SKIY, A. A., LEMANOV, V. V., MAKARENKO, V. A., MARTSINOVSKIY, A. M., and SHERMAN, A. B.

[Abstract] The interaction of surface acoustic waves with electrons and ions of a plasma with Maxwellian energy distribution is investigated by placing the crystal in the positive discharge column. The relationship between surface acoustic wave attenuation and electron concentrations in the plasma is given for discharges in argon and in air; wave attenuation is shown as a function of the acoustic power in the wave for different electron concentrations for an argon discharge. In argon, the attenuation first increases rather rapidly with concentration, after which it drops off and then increases again. The initial rapid increase in attenuation is less clear in air, but the increase becomes sharp in the region of high concentrations. The amount of attenuation for air in the same region is 3 to 4 times lower than for argon. Figure 1, references 3 Russian.
[267-6900]

UDC 534.21

SCATTERING OF PLANE WAVE ON CYLINDRICAL SHELL IN LOW-FREQUENCY REGION

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 23 Jul 82) pp 253-258

PANIKLENKO, A. P. and RYBAK, S. A., Acoustics Institute imeni M. M. Andreyev, USSR Academy of Sciences

[Abstract] The scattering amplitude of a plane wave striking an infinite cylindrical shell at an arbitrary angle in the low frequency region is analyzed. It is found that resonant properties of an infinite cylindrical shell in water will be observed in the scattered field only for shells with thickness of $h/R > 4 \cdot 10^{-2}$ (for steel). No resonance will be noted in the scattered field for inner shells. The introduction of additional losses reduces the scattering amplitude at resonance, and the resonance properties become significant as the shell becomes thicker. References 5: 4 Russian, 1 Western.
[289-65900]

UDC 533.9

STATISTICS OF BEAM ARRIVING AT ASSIGNED POINT IN HETEROGENEOUS MEDIUM WITH FLUCTUATING PARAMETERS

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 11 Nov 82) pp 243-248

MOISEYEV, A. A., Institute of Oceanology imeni P. P. Shirshov, USSR Academy of Sciences

[Abstract] The statistical characteristics of geometric optical beams connecting two preassigned points, a source and a receiver, in a random heterogeneous medium as investigated. The submersion method is used to state the Cauchy problem employed to find the distribution functions of the spatial coordinates and angle of inclination of the beams. The formulas derived are obtained in Markov approximation and assume gaussian quasiuniform fluctuations of the medium. The formulas derived are used to examine the statistics of an acoustic beam propagating in a stratified ocean with statistically uniform and isotropic fluctuations of the index of refraction for a source and receiver located on the axis of an underwater acoustic channel. The results can also be used to calculate space fluctuations of a signal in a random heterogeneous medium by the geometric optics method. References 8 Russian.
[289-6900]

UDC 534.883+534.231.2

SPACE-TIME CORRELATION OF NARROWBAND NOISE SIGNAL IN SHALLOW OCEAN

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 10 Sep 82) pp 233-237

KUDRYASHOV, V. M., Acoustic Institute imeni N. N. Andreyev, USSR Academy of Sciences

[Abstract] The space-time correlation of a narrowband noise signal in a shallow ocean is investigated. It is demonstrated that the duration of the delay correlation function varies in proportion to the distance if the existing composition of the normal waves remains unchanged as the distance between the corresponding points changes. Singularities are demonstrated in the space-time variability of the normalized correlation function due to the fact that the coefficients of attenuation of normal waves in a shallow ocean differ for waves with different numbers. The correlation function of narrowband noise is shown to depend on the correlation coefficient of the radiated signal, the position of the observation points, the waveguide dispersion and the coefficient of attenuation of the normal waves. Figures 4, references 3 Russian.
[289-6900]

UDC 534.8

REORIENTATION OF MAGNETIC MOMENTS OF ANTIFERROMAGNETS IN ACOUSTIC WAVE FIELD

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 4 Oct 82) pp 230-232

KOYRAKH, L. A. and PREOBRAZHENSKIY, V. L., Moscow State University of Electrical Engineering, Electronics and Automation

[Abstract] The processes underlying nonlinear interaction of elastic waves in antiferromagnets with "easy plane" type anisotropy are analyzed within the framework of nonlinear motion equations for the antiferromagnetism vector. Dynamic equilibrium states of the magnetic subsystem exposed to a powerful acoustic wave are analyzed. The conditions for the occurrence of homogeneous static fields are identified for different propagation directions. It is found that new stable equilibrium states can occur in the magnetic and elastic subsystem due to nonlinearity of the magnetoelastic interaction. References 8: 7 Russian, 1 Western.
[289-6900]

UDC 551.463

INFLUENCE OF RANDOM FIELD OF INTERNAL WAVES ON ACOUSTIC PROPAGATION IN THE OCEAN

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 1 Oct 82) pp 183-191

GORSKAYA, N. S. and RAYEVSKIY, M. A., Institute of Applied Physics, USSR Academy of Sciences

[Abstract] The transformation of acoustic wave energy by modes is examined for a real internal wave field with allowance for waveguide losses. Attenuation of the coherent component of the acoustic wave and the variation in a singular spectrum are studied. Losses of low-frequency sound energy due to pumping from modes localized in the waveguide to modes that attenuate on the ocean floor are investigated. These effects are shown to be important in studying sound propagation in the ocean. References 9: 4 Russian, 5 Western.
[289-6900]

UDC 551.596

EXPERIMENTAL INVESTIGATION OF ATTENUATION OF ACOUSTIC GROUND WAVE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 11 Nov 82) pp 171-176

BOCHKAREV, N. N., KRASNENKO, N. P. and MURAVSKIY, V. P., Institute of Atmospheric Optics, Siberian Department, USSR Academy of Sciences

[Abstract] Studies are conducted to identify those factors that influence acoustic wave attenuation near the ground but that can be disregarded to obtain timely data for solving different applications problems by using available theoretical and emperical relationships. The possibility of predicting sound wave attenuation along a path of known length is discussed. The influence of the underlying surface, air turbulence and sound refraction is analyzed. Figures 5, references 10: 2 Russian, 8 Western.
[289-6900]

UDC 534.222

ACOUSTOELECTRONIC NONLINEAR EFFECTS DURING REFLECTION OF ACOUSTIC WAVES

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 4 Nov 82) pp 162-170

BOZHENKO, V. V., VISKUN, T. G., NAYDOV-ZHELEZOV, O. K., and SOLODOV, I. Yu., Moscow State University imeni N. P. Lomonosov

[Abstract] Acoustoelectronic nonlinear interactions between surface and body waves accompanied by acoustically synchronous (harmonic generation, surface of body generation, etc.) and acoustically asynchronous (convolution, correlation during interaction with electric fields, etc.) effects are investigated experimentally and theoretically. Expressions are derived for nonlinear current components and nonlinear potential for different types of wave interaction. The theoretical results are tested experimentally. Figures 4, references 9: 5 Russian, 4 Western.
[289-6900]

UDC 534.221

CONDITIONS FOR COHERENT COMBINATION OF WAVES DURING BACKSCATTERING OF SOUND IN CHANNELS DURING MULTIPATH PROPAGATION

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 22 Oct 82) pp 145-148

AKHUNOV, Kh. G. and KRAVTSOV, Yu. A., Institute of General Physics, USSR Academy of Sciences, Moscow State Pedagogical Institute imeni V. I. Lenin

[Abstract] Coherent effects that can occur in an underwater acoustic channel during multipath propagation are described, and existence conditions for these effects are defined. The possibility of occurrence of coherent effects during backscattering are discussed. It is found that the scattered field intensity can be doubled when multiple beams are present. Figure 1, references 3 Russian.
[289-6900]

UDC 534.232

RADIATION OF BODY MOVING UNIFORMLY OVER PERIODIC STRUCTURE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 9 Aug 81; revised 27 Sep 82) pp 281-283

STAKUN, N. S., Moscow State Pedagogical Institute imeni V. I. Lenin

[Abstract] Radiation by a body moving uniformly in a gas above scattering bodies or streams at subsonic velocity is analyzed. Calculation of the radiated

energy indicates that radiation occurs in a particular direction only for a finite number of discrete frequencies, which corresponds to the analogous finding for electromagnetic radiation. Figures 4, references 3 Russian.
[224-6900]

UDC 534.83

SCATTERING OF WAVES BY 'BLACK' SPHERE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 30 Nov 82) pp 267-272

URUSOVSKIY, I. A., Acoustics Institute imeni N. N. Andreyev, USSR Academy of Sciences

[Abstract] The nature of absorption and scattering of waves by a "comparatively black" body, i.e., a body that absorbs sufficiently completely a sufficiently large number of low converging spatial harmonics, is examined. Conditions are identified under which an incident plane wave scatters in directions close to the direction of incidence. References 6 Russian.
[224-6900]

UDC 534.833

EFFECTIVENESS OF WAVE VIBRATION-ABSORBING COATING OF RIBBED ROD

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 27 Oct 82) pp 259-266

STEPANOV, V. B. and TARTAKOVSKIY, B. D., Acoustics Institute imeni N. N. Andreyev, USSR Academy of Sciences

[Abstract] The effectiveness of a wave coating applied to a rod with rigid transverse ribs is analyzed. It is found that the deformation of the coating increases due to the ribs, resulting in increased attenuation of vibrations in the rod at frequencies below the primary resonance of the coating. When the wave thickness of the coating is small, damping effectiveness increases due to shear deformations in the coating caused by the rigid connection with the rib. Figures 5, references 7: 6 Russian, 1 Western.
[224-6900]

UDC 532.222

ESTABLISHMENT OF FORCED OSCILLATIONS IN ACOUSTIC RESONATORS

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 30 Aug 82) pp 204-212

GUSEV, V. E., Moscow State University imeni M. V. Lomonosov

[Abstract] Simple general equations are derived to describe weakly nonlinear standing waves excited by the oscillations of a piston in a closed tube that vary slowly over time and through space. The mathematical apparatus developed is effective for studying the processes underlying the excitation of standing waves, which corresponds to the most frequently encountered experimental situation. The analytical method is fairly simple, and should be applicable to more complex physical problems. Figures 3, references 16: 11 Russian, 5 Western.
[224-6900]

UDC 534.833.623.8

OPTIMIZATION OF DISSIPATIVE CHARACTERISTICS OF FOUNDATION CONSTRUCTIONS FOR POWER EQUIPMENT

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 11 Aug 82) pp 218-223

IONOV, A. V.

[Abstract] This study discusses the development of validated mathematical models that reflect with sufficient accuracy the real physical processes occurring in the investigated structures from the development of integrated and partial optimization criteria, the investigation of the acceptable range of variation of parameters of the model and the development of optimization algorithms. The choice of an optimal solution is made at two levels: that of individual construction elements (selection of specific types of vibration absorbers), and of the level of the entire construction as a whole (choice of general optimal placement scheme for the vibration absorption means). The results of numerical calculations are presented. References 7 Russian.
[224-6900]

UDC 534.2:532.528

SLOWLY ROTATING PULSED RADIATION SOURCE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 2, Mar-Apr 84
(manuscript received 18 Oct 82) pp 238-242

LEVKOVSKIY, Yu. L.

[Abstract] An approximate analytical solution is obtained for the problem of a rotating monopole such as a propellor, pump vane fan or other bladed mechanism. The radiation is assumed to be pulsed, i.e., occurring in the part of the circular trajectory that a pulse follows. The amplitude of the induced pressure when the sector within which the source radiates is small is found to be independent of the parameter L, which corresponds to the assumption of an incompressible liquid. An example is presented that illustrates the advantage of the approximate solution. References 4: 3 Russian, 1 Western.
[224-6900]

UDC 534.874

MUTUAL SPECTRUM OF RADIATED NOISE SIGNAL AND SIGNAL REFLECTED FROM STRATIFIED OCEAN FLOOR

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 30 Jul 82) pp 137-139

KRASNOBORODʹKO, V. V., Institute of Oceanology imeni P. P. Shirshov, USSR Academy of Sciences

[Abstract] The spectral-correlation characteristic of noise signals scattered from the floor and surface of an ocean are analyzed. The cross-correlation function of the radiated noise signal and the signal reflected from the ocean floor is analyzed. The mutual spectrum of the radiated noise signal and that reflected from the stratified ocean floor is calculated and analyzed. It is found that the presence of strata in the floor causes the mutual spectrum to change significantly. The appearance of interference bands in the phase component of the mutual spectrum is found to be associated with reflection at two or more boundaries. References 2: 1 Russian, 1 Western.
[287-6900]

UDC 534.8

PARAMETRIC EXCITATION OF TRANSVERSE SLOT ACOUSTIC WAVES IN SOLID BODIES BY MICROWAVE ELECTRICAL FIELD

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 22 Jul 82) pp 132-134

BONDARENKO, T. I. and BURLAK, G. N., Kiev State University imeni T. G. Shevchenko

[Abstract] It is demonstrated that a high frequency electrical pumping field with frequency ω_p can generate transverse acoustic waves with frequency Ω that propagate along the boundary of two electrostriction crystals. Parametric resonance of colliding acoustic waves at frequencies Ω and $-\Omega+2\omega_3$ is shown to occur when the frequencies of the field and the acoustic waves are the same. Numerical analysis reveals that the spectrum of transverse slot surface acoustic waves in semi-bounded crystals in a microwave electric field has a zone in which transmission is impeded in the region of parametric instability. References 5: 4 Russian, 1 Western.
[287-6900]

UDC 551.463.26

INVESTIGATION OF IRREGULARITIES OF OCEAN BOTTOM BY AMPLITUDE-MODULATED SIGNAL

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 29 Jun 82) pp 118-121

SHEYNFEL'D, I. V., Scientific Research Radio Physics Institute

[Abstract] A method is proposed for using amplitude-modulated radiation to assess the statistical characteristics of an irregular ocean floor. Experiments are conducted in which the statistical characteristics of the envelope of the amplitude-modulated sound scattered by the ocean floor are measured as a function of the modulation frequency. The local coefficient of reflection is assumed to be constant. Figures 3, references 6 Russian.
[287-6900]

UDC 534.21.1

ANALYSIS OF HORIZONTAL REFRACTION OF ACOUSTIC WAVES IN SHALLOW OCEAN BY PERTURBATION METHOD

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 24 Jul 82) pp 79-82

KRAVTSOV, Yu. A., KUZ'KIN, V. M. and PEPNIKOV, V. G., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] Variations in the angles of arrival of acoustic waves are analyzed on the basis of perturbation theory for horizontal waves. Simple quadrature formulas are obtained for the refraction angles in the horizontal plane, as well as for the group delays. The perturbation method is employed in a form suitable for horizontal waves corresponding to adiabatic normal waves in a heterogeneous shallow ocean. Examples are cited that demonstrate the method. Perturbation theory is found to provide convenient analytic expressions for the variations in the angles of horizontal refraction and group delay that relate the measured angles of arrival and delays to the ocean parameters. Figure 1, references 9: 8 Russian, 1 Western.
[287-6900]

UDC 534.231

RADIATION OF EQUATORIAL SPHERICAL BAND WITH PULSATING SURFACES

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 11 Aug 82) pp 66-73

KELEBERDENKO, S. B., OBOZNENKO, I. L. and SKRYNCHENKO, V. A.

[Abstract] The characteristics of the radiation field of an equatorial band with surfaces pulsating in phase with the quantity y varying from 0 to 1 are studied. The corresponding boundary value problem is solved numerically by the least-squares method on the basis of a functional of a more general type than that employed in other studies. The resonant properties of an equatorial spherical band with pulsating inner and outer surfaces are analyzed. Figures 6, references 8: 7 Russian, 1 Western.
[287-6900]

UDC 534.222

SIMILARITY CRITERIA OF SPECTRA OF PRESSURE PULSATIONS OF TURBULENT BOUNDARY LAYER NEAR WALL

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 29 Nov 82) pp 58-61

YEFIMTSOV, B. M.

[Abstract] Extensive data are presented on the spectra of pressure pulsations of the turbulent boundary layer near a wall for a wide range of Mach, Reynolds and Strouhal numbers obtained through a unifieid measurement method employing detectors with good spatial resolution. Two basic similarity criteria for the spectra of turbulent pressure pulsations near a wall are identified. Figures 5, references 6: 4 Russian, 2 Western.
[287-6900]

UDC 620.178.4:534.8

SIMULATION OF VIBRATION PROCESSES IN DAMPED STRUCTURES WITH ALLOWANCE FOR TEMPERATURE-FREQUENCY CHARACTERISTICS OF VIBRATION ABSORBING MATERIALS

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 24 Jul 82) pp 18-22

BUVAYLO, L. Ye and IONOV, A. V.

[Abstract] Scale modeling is employed to examine vibration processes occurring in damped structures with allowance for the temperature and frequency characteristics of vibration absorbing materials. Laminated rods are studied as an example for the case of rigid vibration absorbing coatings (2-layered structures) and reinforced coatings or "sandwich" construction (3-layered structures). Allowance is made for the temperature-frequency behavior of the dynamic characteristics of viscous elastic vibration absorbing materials. Figures 3, references 4 Russian.
[287-6900]

UDC 534.26

INTRINSIC OSCILLATIONS OF BARRIER IN INFINITE WAVEGUIDE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 9 Jul 82) pp 14-17

BELINSKIY, B. P., Leningrad State University imeni A. A. Zhdanov

[Abstract] The existence of intrinsic oscillations in a flat infinite waveguide with ideally rigid walls in which a thin flexible oscillating barrier is

placed is demonstrated. It is shown that the parameters for which the determinant of the system of linear algebraic equations employed is zero may coincide, thus rsulting in intrinsic oscillations. An analogous approach can be used to study a waveguide containing a flexible oscillating plate articulated at the ends. Figure 1, references 3: 1 Russian, 2 Western.
[287-6900]

UDC 534.2:621.375.8

INFLUENCE OF RADIATION WAVELENGTH ON ELASTIC PULSE SHAPE DURING LASER EXCITATION

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 14 May 82) pp 5-9

ARKHIPOV, V. I., BONDARENKO, A. N. and KONDRAT'YEV, A. I., "Dal'standart" Scientific Production Association

[Abstract] The influence of radiation wavelength on the shape of laser-excited elastic pulses is investigated to explain the mechanisms underlying the optical generation of sound. The experimental setup is described, and the calculated values are shown to agree well with the experimental findings. The wavelength of the laser radiation is found to have a strong influence on the shape of the electric pulses, which must be taken into account in investigations of the optical generation of plastic waves. Figures 6, references 5 Russian.
[287-6900]

UDC 621.37/39:534

DIRECTIONALITY OF RADIATION OF FAN-SHAPED INTERDIGITAL SURFACE ACOUSTIC WAVE TRANSDUCER

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 29, No 5, Sep-Oct 83
(manuscript received 20 Apr 82) pp 708-710

KOBA, S. I.

[Abstract] An error is identified in a previous study of the amplitude distribution of a surface acoustic wave over the aperture of a fan-shaped interdigital transducer [A. B. Karro-Est, V. V. Polyakov, A. N. Rozhdestvenskiy, "Directionality of Radiation of Fan-Shaped Interdigital Surface Acoustic Wave Transducer", AKUSTICHESKIY ZHURNAL, Vol 27, No 4, 1981, pp 620-623]. It is shown that the error results in an estimate of the width of the first acoustic bundle according to the first zeros of the amplitude function that is actually half that indicated in the previous study. The figures yielded by the corrected formula agree well with measurements of the amplitude and phase of a surface acoustic wave along the aperture of a fan-shaped interdigital transducer. Figures 1, references 2 Russian.
[281-6900]

UDC 534.24

RELATION BETWEEN LATERAL DISPLACEMENT OF ULTRASONIC BEAM AND COEFFICIENT OF ATTENUATION OF NORMAL WAVE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 29, No 5, Sep-Oct 83
(manuscript received 22 Sep 81) pp 715-716

SVIRIDOV, Yu. B., Institute of Mathematics, Computer Center, Moldavian SSR Academy of Sciences

[Abstract] The relation between lateral displacement of an ultrasonic beam and the coefficient of attenuation of the normal wave excited by that beam on a liquid-solid phase interface is investigated. A study is performed for the case in which the coefficient of attenuation of a normal wave is significantly smaller than its propagation constant due to radiation in the liquid. Formulas are derived for the wave number of surface and normal waves by the perturbation method. The formula for the wave number of the surface wave can be used to find the coefficient of attenuation of a surface wave from the measured amount of lateral displacement of the beam. References 10: 6 Russian, 4 Western.
[281-6900]

UDC 534

POLARIZATION OF ULTRASOUND TRANSMITTED THROUGH BOUNDARY OF MAGNETICALLY INACTIVE AND EQUATORIALLY MAGNETIZED MEDIA

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 29, No 5, Sep-Oct 83
(manuscript received 15 Mar 82) pp 702-704

BABUSHKIN, G. A., Institute of Metallurgy, Urals Scientific Center, USSR Academy of Sciences

[Abstract] The polarization of all types of elastic waves passing through the interface of a nonmagnetic medium and an equatorially magnetized medium is investigated as a function of the angle of incidence of the wave on the boundary and the nature of hypotrophy of the second medium. The hypotrophy of the medium is detemrined phenomenologically through the effective antisymmetrical components of the tensor of the moduli of elasticity. These components are a function of the field H and the ultrasound frequency ω, and characterize the change in velocity and absorption of elastic waves in the magnetic field. The ellipticity and orientation of major axes of ellipses of polarization are investigated with respect to the refraction vectors. The findings are valid (disregarding spatial dispersion of the moduli of elasticity) for elastic isotropic crystals, polycrystals, and hexagonal crystals magnetized along the principal crystallographic axis when ultrasound propagates perpendicular to the axis. Reference 1 Russian.
[281-6900]

UDC 534.26

CHANGE IN PROPAGATION DIRECTION OF SURFACE ACOUSTIC WAVES WITH HELP OF PERIODIC SYSTEMS OF IRREGULARITIES

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 29, No 5, Sep-Oct 83
(manuscript received 14 Jun 82) pp 700-702

ALYAKNA, Yu. Yu. and PLESSKIY, V. P., Institute of Electric Engineering Electronics, USSR Academy of Sciences

[Abstract] The reflection of Rayleigh surface acoustic waves from a periodic lattice with irregularities arranged at an arbitrary angle $\pi/2-\theta$ to the edge of the lattice is examined. The amplitude in this case is constant on the line y=0, rather than along the channels, so that the structure of the waves and the dispersion equation are different than for the case in which the amplitude is constant along the channels. Expressions are derived to express the wave vectors for the incident and reflected waves in the region of the lattice. The results make it possible to calculate the reflection of surface acoustic waves from a bounded lattice by using only the elastic constants of the material and the geometry of the array. Figures 2, references 3 Russian.
[281-6900]

UDC 534.874.3

TRANSIENT ACOUSTIC RADIATION BY MASS SOURCE MOVING OVER UNEVEN SURFACE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 29, No 5, Sep-Oct 83
(manuscript received 19 May 82) pp 673-677

PAVLOV, V. I. and SUKHORUKOV, A. I., Department of Acoustics, Moscow State University imeni M. V. Lomonosov

[Abstract] Quantitative characteristics of acoustic wave radiation occurring during the movement of a mass (or heat) source in a homogeneous medium near an uneven surface are obtained. Subsonic movement of the source, for which there is no Vavilov-Cherenkov radiation is examined, and the heterogeneity of the medium is the sole cause for the occurrence of radiation. A system of equations is derived for describing the movement of the medium. Radiation patterns for a number of characteristic parameters are presented. The pressure amplitudes, like the total radiation intensity, are very sensitive to the choice of parameters. Figures 3, references 4 Russian.
[281-6900]

UDC 534.222

CONDITIONS FOR OPTIMAL ABSORPTION OF ENERGY IN MULTILAYERED RESONANT SYSTEMS

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 29, No 5, Sep-Oct 83
(manuscript received 5 Apr 82) pp 625-630

KRASIL'NIKOV, M. V., Institute of Electrical Engineering and Electronics, USSR Academy of Sciences

[Abstract] A multilayered interference wave energy absorber type system is examined. The integral characteristics are analyzed on the basis of a slowly-varying amplitude method. The structures of the traveling wave fields are analyzed in resonators consisting of alternating layers of two media with similar acoustic properties, plus a slightly absorbing working layer. The slowly-varying amplitude method makes it possible to follow the distribution of the absolute values of the amplitudes of the direct and reverse waves in the system, makes the calculation significantly easier and provides a clearer picture of the processes occurring in multilayer resonant systems, including the capability of observing the propagation of the direct and return waves in the system. It can also be used to calculate the standing wave field in analogous wave systems. Figures 2, references 11 Russian.
[281-6900]

UDC 534.87

SPATIAL CORRELATION FUNCTION OF NOISE FIELD OF VIBRATIONAL VELOCITY OF SIGNAL AND INTERFERENCE IN WEDGE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 29, No 5, Sep-Oct 83
(manuscript received 25 Nov 80; revised 9 Mar 82) pp 619-624

KARNOVSKIY, A. M.

[Abstract] The spatial correlation function of the fluctuating signal and interference field, as well as the signal/interference ratio, are determined in a wedge-shaped waveguide. The signal field is assumed to be created by a local source, and the interference field is created by a set of local sources located within the wedge. The spatial correlation functions of the signal and interference are defined, and the signal/interference ratio in the acoustic field of each component of the vibrational velocity is calculated. The findings can be used to synthesize and analyze combined optimal space-time processing channels for vector and scalar acoustic signals in a wedge-shaped waveguide, and are also suitable for optimization in orienting a space processing channel within a waveguide. Figures 2, references 11 Russian.
[281-6900]

UDC 534.6:621.396.67

DETERMINING GAIN OF ACOUSTIC ANTENNA ARRAY FROM PRESSURE MEASURED IN FRESNEL ZONE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 29, No 5, Sep-Oct 83
(manuscript received 30 Apr 81; revised 21 Apr 82) pp 615-618

ZEMLYAKOV, V. L. and NIKESHIN, S. G.

[Abstract] A method is described for determining the gain of an antenna array from pressure measurements in the Fresnel zone by using beam expansion of the spherical wave created by the antenna. The proposed method is unusual in that a system of equations was used to determine the gain. The gain of a model of a linear antenna array consisting of 9 omnidirectional elements is analyzed as an example. The results indicate the possibility of employing the formulas derived to determine the gain of an acoustic array from the pressure measured in the Fresnel zone. Figures 4, references 9 Russian.
[281-6900]

UDC 534.26

ACOUSTIC ATTENUATION SURFACES IN CUBIC CRYSTALS

Leningrad FIZIKA TVERDOGO TELA in Russian Vol 26, No 4, Apr 84
(manuscript received 26 Oct 83) pp 1013-1015

LEMANOV, V. V., KIM, V. S. and NASYROV, A. N., Physical-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences

[Abstract] The components of the viscosity tensor are found from experimental attenuation data; acoustic attenuation surfaces are constructed for $Y_3Al_5O_{12}$. Ge, CaF_2 and LiF crystals. Formulas are derived that can be used in conjunction with tabulated tensor components to compute the attenuation in any direction, i.e., to construct the acoustic attenuation surfaces. Figures 5, references 8: 3 Russian, 5 Western.
[327-6900]

UDC 533:92:621.039.61

EFFECT OF LIQUID PHASE COMPOSITION ON THICKNESS OF EPITAXIAL $Ga_{1-x}Al_xAs$ FILMS

Tashkent IZVESTIYA AKADEMII NAUK UZ SSR: SERIYA FIZIKO-MATEMATICHESKIKH NAUK in Russian No 1, Jan-Feb 84 (manuscript received 13 Jan 82) pp 73-74

AKBAROV, N. F., BUSTANOV, Kh. Kh., MIRZABAYEV, M. M., ESHMETOV, I. and TURSUNOV, M. N., Physico-technical Institute imeni S. V. Starodubtsev, UzSSR Academy of Sciences

[Abstract] The quality of the GaAs-AlAs heterojunction system multilayer structures can be improved by precise control of the thickness of the $Ga_{1-x}Al_xAs$ layers and optimization of their parameters. An experimental study was made of the dependence of the thickness of the $Ga_{1-x}Al_xAs$ layer on the aluminum content of the liquid phase of the growth process at temperature levels of 920, 870, 820°C on gallium arsenide bases. Increase in solution aluminum content from zero to 2 at.% led to a fall in film thickness by a factor of 2.5-3. Anistropy of epitaxial growth was not observed. Thickness can thus be controlled by modulating aluminum content. By utilizing a limited volume of heavy solution it is possible to obtain prescribed layer thicknesses. Figure 1, references 5 Russian.
[241-12497]

UDC 621.315.592

IONIZATION AS FACTOR STIMULATING RECRYSTALLIZATION OF SEMICONDUCTORS

Tashkent IZVESTIYA AKADEMII NAUK UZ SSR: SERIYA FIZIKO-MATEMATICHESKIKH NAUK in Russian No 1, Jan-Feb 84 (manuscript received 22 Jun 82) pp 45-48

OKSENGENDLER, B. L., PAKHARUKOV, Yu. V. and YUNUSOV, M. S., Institute of Nuclear Physics, UzSSR Academy of Sciences

[Abstract] Electron excitation is known to play a part in laser, electron and ion recrystallization but there is insufficient data as to the effectiveness of the various types of atomic reorganization and the study considers the role of ionization in stimulating large-scale processes. The transition of a metastable amorphous semiconductor to a stable crystalline state is considered.

Ionization transfers electrons from the valence band to the conduction band which modifies the dissociation energy of the crystalline and amorphous phases. Formation of single crystal nuclei in the amorphous semiconductor is determined by energy relations and barriers and as excitation increases in the two phases the energy characteristics move together. Ionization can also affect the thermodynamically determined stability of the interphase boundary and can produce a transformation of amorphous to single crystal states. Numerical calculations evaluated the effectiveness of the two phase transformation states and showed that interphase boundary variation was less effective than the nucleus formation barrier modification mode which is also probably responsible for experimentally observed partial polycrystalline recrystallization.
References 5: 3 Russian, 2 Western.
[241-12497]

UDC 621.317.346

CORRELATION METHOD FOR MEASURING NOISE IN SEMICONDUCTOR RADIATION DETECTORS

Tashkent IZVESTIYA AKADEMII NAUK UZ SSR: SERIYA FIZIKO-MATEMATICHESKIKH NAUK in Russian No 1, Jan-Feb 84 (manuscript received 15 Jan 82) pp 39-41

KHABIBULLAYEV, P. K., MURATOV, A. F., POD"YACHEV, V. N. and TATEOSOV, V. G., Tashkent

[Abstract] Improved semiconductor technology has made it possible to considerably reduce noise in X-ray and soft gamma-ray detectors. Detector noise values must be measured to estimate semiconductor quality, evaluate production characteristics and series produced instrument design and to measure input parameters and effects of external conditions on detector noise level. A new method is proposed for measuring detector noise and that of similar bipolar devices by means of field-effect transistors used as input stages for two charge-sensitive preamplifiers linked to the current-generating detector. A correlation device then makes it possible to discriminate detector noise. The method can measure noise an order of magnitude less than the detector noise and only a relatively low level of instrumental stability is required. It has been applied to series produced detection instruments such as radiation units operating at cryogenic temperatures. Figure 1, references 3 Russian.
[241-12497]

ANOMALOUS MAGNETIC RESISTIVITY OF PLASTICALLY DEFORMED GERMANIUM

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 39, No 6, 25 Mar 84 (manuscript received 20 Jan 84) pp 249-252

ZHARIKOV, Yu. A., OSIP'YAN, Yu. A. and SHEVCHENKO, S. A., Institute of Solid State Physics, USSR Academy of Sciences

[Abstract] Recent research on systems of different dimensions has led to quantum coherent theories of weak electron localization and electron-electron interaction to explain anomalous magnetic resistivity in semiconductors and

metals. Application of these theories is studied through experimental research on strongly plastically (25-40%) deformed Ge and resistivity is measured for various magnetic field intensities (0-20 kOe) and temperatures of 0.6-10 K. The appearance of anomalous magnetic resistivity for weak field currents (10^1-10^4 Oe) and the demonstrated temperature relations agree qualitatively with other semiconductor experimental results. The authors suppose that in the deformed Ge processes the dislocation structure has different dimensionalities and that quantum coherent events (weak electron localization or electron-electron interaction depending upon scale) affect conductivity in the magnetic field. Figures 3, references 9: 8 Russian, 1 Western.
[247-12497]

UDC 621.315.592

LUMINOUS POINTS AND BREAKDOWN IN STRUCTURE OF GaAs TRANSISTORS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 17, No 11, Nov 83 (manuscript received 25 Mar 83), pp 1931-1934

GASAN-ZADE, S. G., SAL'KOV, Ye. A. and SHEPEL'SKIY, G. A.

[Abstract] Physical effects preceding breakdown and failure of GaAs field-effect transistors are studied. Irreversible structural changes are experimentally shown to be linked to the appearance of radiation at the drain layered according to differential conductivity and forming luminous points which increase in size as the potential rises. Liquid Ga then forms and conductive channels near the brightest points at the drain lead to irreversible breakdown followed by burn-out. It is found that there are different mechanisms for point formation and Schottky barrier failure and for the drain domain failure. This is supported by the spectra since radiation from drain points is shifted to the shortwave range because of the higher space charge region field on the Schottky barrier in comparison with the drain domain field. Figures 2, references 5: 4 Russian, 1 Western.
[269-12497]

UDC 543.5+539.211

COMPOSITION OF METAL FILMS ON GALLIUM ARSENIDE SURFACE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 273, No 6, Dec 83 (manuscript received 30 Jun 83), pp 1345-1348

ALESHIN, V. G., NEMOSHKALENKO, V. V., SEMASHKO, Ye. M. and SENKEVICH, A. I., Institute of Metal Physics, UkSSR Academy of Sciences, Kiev

[Abstract] The technically important electrical characteristics of the metal-GaAs contact are determined by the characteristics of the materials, metal deposition conditions and boundary interaction that form the transitional zone.

The composition of the metal films at the boundary and the effect of high temperature heat treatment are studied by X-ray electron spectral analysis. It is established that during metal deposition the GaAs boundary decomposes and arsenic and gallium enter the metal film. At high temperatures, complex multilayer and multicomponent processes occur in the GaAs-metal system that depend on the thermodynamics of the total boundary layer system. The electrical characteristics of the metal-GaAs contact deteriorate because of metal ions in the semiconductor, changes in GaAs layer ctoichiometry due to metal interaction and defect formation inducing states in the GaAs forbidden band and increasing barrier tunneling. Figures 3, references 11: 5 Russian, 5 Western. [220-12497]

UDC 621.382

EFFECT OF NEGATIVE DIFFERENTIAL CONDUCTIVITY IN QUASI-TWO-DIMENSIONAL SEMICONDUCTOR SUPERLATTICES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 273, No 6, Dec 83 (manuscript received 17 May 83) pp 1351-1355

IGNATOV, A. A., Institute of Applied Physics, USSR Academy of Sciences, Gorkiy

[Abstract] The characteristics of superlattice (GaAlAs) semiconductor miniband carrier mobility that produces the negative differential conductivity effect leading to microwave generation have been studied by numerical Monte Carlo methods. This work is continued in the paper that analytically studies superlattice fluctuations and high-frequency characteristics. A correlation function is obtained for carrier fluctuations. Carrier diffusion coefficients are computed, enabling determination of characteristic wave build-up scales and increments, and establishment of characteristic stimulated emission frequencies. Quasi-two-dimensional GaAlAs superlattices are shown to have negative differential conductivity in a broad frequency range covering the submillimeter band and the planar structure assures significant emission power. They are of great interest as solid-state sources for extremely high frequencies. Figure 1. [220-12497]

TUNNEL CENTERS WITH NEGATIVE U AND PHOTOSTIMULATED REACTIONS IN SEMICONDUCTORS

Moscow PIS'MA V ZHURNAL ESKPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 39, No 5, 10 Mar 84 (manuscript received 9 Jan 84) pp 211-213

BAGRAYEV, N. T. and MASHKOV, V. A., Physical-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences

[Abstract] The occurrence of negative U is examined for the case characterized by the absence of the Jahn-Teller effect and significant deformations of the deep center wave functions as the charge state varies. The transition of a

center to a new equilibrium position as its charge state changes is the equivalent of Jahn-Teller distortion in the proposed model. A tunnel system with two-electron, single-electron and empty charge states is examined. The tunnel systems of centers that are detected are found to have negative U due to the fact that the electron-vibrational interaction constant depends on the charge state. Figures 2, references 10: 3 Russian, 7 Western.
[246-6900]

UDC 621.382.2

CURRENT-VOLTAGE CHARACTERISTICS OF DIODE STRUCTURES BASED ON GALLIUM ARSENIDE COMPENSATED WITH MANGANESE OR IRON

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 26, No 10, Oct 83 pp 79-95

GAMAN, V. N., Siberian Physical-Technical Institute V. D. Kuznetsov, Tomsk State University

[Abstract] The possible nature of the electron processes responsible for charge transfer during direct and reverse shifts in diode structures based on gallium arsenide compensated with impurities containing deep centers is discussed. The behavior of the forward and reverse branches of the current-voltage characteristics is described. GaAs (Mn) diode structures, the tunnel-recombination current component, dual injection current in p-π-η-n structures and GaAs (Fe) diode structures are characterized. The influence of these levels on the temperature behavior of switching parameters is analyzed, and switching time is studied as a function of diode voltage. Figures 10, references 40: 29 Russian, 11 Western.
[265-6900]

UDC 621.382.2

GALLIUM ARSENIDE AVALANCHE S-DIODES

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 26, No 10, Oct 83 pp 67-78

KHLUDKOV, S. S., Siberian Physical-Technical Institute imeni V. D. Kuznatsov, Tomsk State University

[Abstract] Promising areas for the use of high resistance crystals and layers of gallium arsenide doped with impurities with deep centers as active components in electronic devices are demonstrated. The basic methods for obtaining high resistance layers are characterized, and some of the characteristics of diffusion doping of gallium arsenide with transition element impurities are described. Using the processes that occur in the strong electric fields present

in the reverse branch of the current-voltage characteristic makes it possible to obtain higher speed (by 3 or 4 orders of magnitude) in S-diodes than in existing injection S-diodes. Figures 8, references 67: 57 Russian, 10 Western.
[265-6900]

UDC 621.315.592

DEEP CENTERS IN GALLIUM ARSENIDE ASSOCIATED WITH INTRINSIC STRUCTURAL DEFECTS

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 26, No 10, Oct 83 pp 56-66

BOLTAKS, B. I., KOLOTOV, M. N. and SKORYATINA, Ye. A.

[Abstract] A review is presented of work on point defects in gallium arsenide. Methods for the controlled introduction of point defects in gallium arsenide are described. Radiation defects, point defects produced during the growing stage, defects in deformed gallium arsenide and heat treatment defects are described. It is found that most deep centers that are introduced by electron radiation, heat treatment and during growing differ from one another, meaning that they probably have different structures. Figures 8, references 58: 12 Russian, 46 Western.
[265-6900]

UDC 621.315.592

ELECTRON STRUCTURE OF DEEP CENTERS IN GALLIUM ARSENIDE

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 26, No 10, Oct 83 pp 45-55

MASTEROV, V. F., Leningrad Polytechnical Institute imeni M. R. Kalinin

[Abstract] Local and band methods for calculating the electron structure of deep centers are described. Impurity atoms of the ferrous transitional group in broad band A^3B^5 are investigated experimentally, including titanium, vanadium, chromium, manganese, iron, cobalt and nickel. Directions of further research are discussed. Figures 4, references 25: 10 Russian, 15 Western.
[265-6900]

UDC 621.315.592:548.552.22

IMPURITY TRAPPING DURING GAS PHASE EPITAXY OF GALLIUM ARSENIDE

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 26, No 10, Oct 83 pp 31-44

LAVRENT'YEVA, L. G.

[Abstract] The possibility of using models of equilibrium impurity distribution between phases and nonequilibrium trapping limited by surface kinetics for describing doping principles during gallium arsenide epitaxy in chalcogenide-hydrogen systems is discussed. The equilibrium approximation is found to describe satisfactorily the nature of variation in the concentration of an atomic impurity in the gas phase near the growth surface; however, it does not reflect adequately the principles underlying the transition of the impurities from the gaseous to the solid phase. As a first approximation, the Barton-Cabreri-Frank model describes satisfactorily the kinetics of impurity trapping during gas phase epitaxy of gallium arsenide; however, the application of this model to crystallization in gas phase epitaxy systems was restricted because of the complexity of the systems and the need for taking into account the behavior of chemical reactions in relatively dense adsorption layers. Figures 8, references 46: 27 Russian, 19 Western.
[265-6900]

UDC 621.315.592.2:546.681'19

NONEQUILIBRIUM TRAPPING OF DEEP CENTERS DURING LIQUID-PHASE EPITAXY OF GALLIUM ARSENIDE

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 26, No 10, Oct 83 pp 18-30

BOLKHOVITYANOV, Yu. B., KRAVCHENKO, A. F. and CHIKICHEV, S. I.

[Abstract] The current status of the problem of obtaining high resistance layers of GaAs in liquid phase epitaxy is discussed. The resistivity of gallium arsenide with deep centers is analyzed, and phase equilibrium in GaAs-Fe and GaAs-Cr systems is studied. Dual doping in liquid phase epitaxy of semiinsulating gallium arsenide is analyzed, along with the kinetics of the trapping of deep centers of iron and chromium. Figures 5, references 53: 27 Russian, 36 Western.
[265-6900]

UDC 621.315.592

SEMIINSULATING GALLIUM ARSENIDE FOR MICROWAVE ELECTRONICS

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 26, No 10, Oct 83 pp 5-17

MIL'VIDSKIY, M. G., OSVENSKIY, V. B. and SHERSHAKOVA, N. N.

[Abstract] The electrophysical properties of semiinsulating gallium arsenide, both undoped and doped with various impurities, are described. The influence of the properties of the original material on the characteristics of GaAs layers obtained by impurity implantation are analyzed. The temperature stability of semiinsulating gallium arsenide is examined, and the state and prospects for developing technology for obtaining semiinsulating gallium arsenide are discussed. Figures 4, references 25: 3 Russian, 22 Western.
[265-6900]

PROBLEM OF DEEP CENTERS IN GALLIUM ARSENIDE

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 26, No 10, Oct 83 pp 2-4

KRAVCHENKO, A. F., professor

[Abstract] This paper serves as a preface to a collection of studies on deep centers in gallium arsenide. The studies described reflect the current state of studies on deep centers, as well as the findings from original work by the various authors. Most of the articles included were originally reported at the Fifth Union Conference on the Investigation of Gallium Arsenide that was held in September 1982 in Tomsk.
[265-6900]

UDC 535.376

X-RAY LUMINESCENCE OF LaF_3 SINGLE CRYSTALS ACTIVATED WITH Nd AND Pr

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 2, Feb 84 (manuscript received 4 Nov 82) pp 333-335

ZININ, E. I., KRAVCHENKO, A. I., MIKHAYLIN, V. V., CHERNOV, S. P. and SHEPELEV, A. V.

[Abstract] The visible and ultraviolet luminescence of LaF_3 activated with Nd and Pr is investigated at 300 and 77 K. X-ray luminescence is excited by synchrotron radiation from a VEPP-3 accumulator with a maximum quantum energy of approximately 4 keV. A wide ultraviolet band which appears for both crystals at 77 K is described. Figure 1, references 7: 5 Russian, 2 Western.
[277-6900]

UDC 537.311.33

INFLUENCE OF GROWING CONDITIONS OF $Al_xGa_{1-x}As$-GaAs HETEROSTRUCTURE IN MOS-AsH_3-H_2 SYSTEM ON PARAMETERS OF SOLAR CELLS

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 1, Jan 84 (manuscript received 9 Mar 83) pp 187-189

KAGAN, M. B., LYUBASHEVSKAYA, T. L., MIL'VIDSKIY, M. G., NALIVAYKO, I. I., TIMASHKOV, V. M. and FATYUSHINA, N. P., State Scientific Research and Design Institute of Rare Earth Metals Industry, Moscow

[Abstract] The influence of the growing temperature and atomic ratio As/Ga in the gaseous phase on the electrophysical properties of epitaxial layers of GaAs forming an active region in a solar cell structure, and accordingly on its photoelectric parameters, is studied. The spectral distribution of the collection coefficient of the solar cell and the light load response of a typical solar cell are analyzed. The experimental efficiencies of approximately 17% indicate that the organometal gas-phase epitaxy method is promising for the mass production of high efficiency solar cells. Figures 4, references 5: 1 Russian, 4 Western.
[197-6900]

EFFECT OF LIGHT PULSES ON FILM OF CHALCOGENIDE VITREOUS SEMICONDUCTORS

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 1, Jan 84 (manuscript received 17 Mar 83) pp 186-187

KOLOBOV, A. V. and SEBAST'YAN, N., Physical-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] Findings are presented from experiments on exposing AsSe films, in which photostructural transformations are expressed most clearly, to short light pulses (λ=520 nm, τ=200 ns). The change in transmission is found to be independent of the light intensity for intensity smaller than approximately 10^5 W/cm^2, indicating that the light intsneity and the number of pulses are interchangeable. The transmission is observed to change more for higher light intensities, showing increased light sensitivity. The hypothesis of a thermal mechanism underlying variation in the transmission of chalcogenide vitreous semiconductor films subjected to pwoerful light pulses is verified experimentally. A light intensity region is shown to exist within which the light sensitivity increases by up to two orders of magnitude. Figures 2, references 6: 4 Russian, 2 Western.
[197-6900]

UDC 532.376.2

SPECTRAL BEHAVIOR OF DELAY OF RADIATION OF (GaAl)As DIODES

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 1, Jan 84
(manuscript received 13 Feb 83) pp 173-175

POPOV, Yu. V. and TRAPEZNIKOV, M. B.

[Abstract] The radiation spectrum of structures based on unilateral and bilateral heterojunctions is used to measure radiation delay. The delay behavior, according to the spectrum of the modulated radiation, differs for devices fabricated in different ways due to re-radiation of the stream of generated photons and the coexistence of several electroluminescence channels. The behavior of $td(\lambda)$ is found to depend upon the mechanism underlying the formation of the spectral relationship between the delay and autoabsorption for "zonality" of the active region. The depth at which reradiation effects occur is determined in part by the size of the radiation recombination quantum yield. Figures 2, references 7: 6 Russian, 1 Western.
[197-6900]

UDC 621.382

FIELD RELAXATION IN WAVEGUIDE METAL-DIELECTRIC-SEMICONDUCTOR ELECTROABSORPTION OPTIMAL MODULATOR

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 1, Jan 84
(manuscript received 11 Jan 83) pp 110-114

MAKSIMOV, A. V., BLAGODAROV, A. N. and NAGOVITSYN, N. A., Leningrad Polytechnical Institute imeni M. I. Kalinin

[Abstract] A study is presented of electrical field relaxation in an MDS waveguide caused by the generation of electron-hole pairs, which is one of the factors underlying the dependence of the modulator parameters on the intensity of the modulating light. The MDS modulator is described, and equations are derived to describe the electrical field of relaxation. If the holes are captured by traps at the interface, the field does not relax regularly along the modulator; if the holes are distributed uniformly under the electrode, the relaxation is simultaneous. Formulas are derived that describe the operation of the modulator. Figures 5, references 2 Russian.
[197-6900]

UDC 535.376:621.382.015.5

SPECTRAL DISTRIBUTION OF RADIATION IN p-n JUNCTIONS OF GaAs DURING AVALANCHE BREAKDOWN

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR: SERIYA FIZICHESKIKH I TEKHNICHESKIKH NAUK in Russian No 2, Mar-Apr 84 (manuscript received 7 Jun 83) pp 43-48

DZELME, B. M., BALODIS, Ya. K., PURITIS, T. Ya. and BOCHKANS, Ya. P., Riga Polytechnical Institute imeni A. Ya. Pel'she, Physical-Power Institute of Latvian SSR Academy of Sciences

[Abstract] The spectral distribution of GaAs p-n junctions during breakdown from small p-n junctions is studied to obtain a spectrum with less distortion. The radiation spectrum during avalanche breakdown of p-n (or n-p) GaAs junctions is wide (extending to photon energies of 3.5 eV) and smooth, with a slight maximum at energy corresponding to the width of the forbidden band of GaAs. The occurrence of a peak in the spectrum of radiation with photon energy close to that of the forbidden band of GaAs may be due to photoluminescence of the area surrounding the breakdown region. References 11: 1 Russian, 10 Western.
[279-6900]

UDC 541.14:535.217

KINETICS OF OXIDATION AND CHANGE IN STATE OF SURFACE OF LASER-HEATED METAL SURFACE

Moscow POVERKHNOST': FIZIKA, KHIMIYA, MEKHANIKA in Russian No 4, Apr 84 (manuscript received 28 Oct 82; revised 11 Mar 83) pp 134-144

BOVYREV, V. A., BUNKIN, F. V., KURICHENKO, N. A., LUK'YANCHUK, B. S., SIMAKIN, A. V. and SHAFEYEV, G. A., Institute of General Physics, USSR Academy of Sciences

[Abstract] The growth dynamics of the oxide layer of metal subjected to CO_2 laser radiation in air is studied. The morphology of the laser is diagnosed optically. The differences between the kinetics of laser oxidation and isothermic oxidation are established; the most important factors determining these differences are identified for a number of metals. References 28: 22 Russian, 6 Western.
[282-6900]

UDC 621.315.592

SHOCK IONIZATION COEFFICIENTS OF ELECTRONS AND HOLES IN NARROW-BAND InAs SOLID SOLUTIONS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 18, No 3, Mar 84 (manuscript received 20 Sep 83; signed to press 28 Sep 83) pp 545-547

ANDREYEV, I. A., MIKHAYLOVA, M. P., SEMENOV, A. N., SLOBODCHIKOV, S. V., STUS', N. M. and FILARETOVA, G. M., Physical-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] Avalanche photocurrent multiplication and shock ionization in narrow-band InAs-based solid solutions are investigated in order to determine the possibility of using them in internal-gain photodetectors for infrared fiber optic systems. The results of the investigations indicate that avalanche photodiodes with high ionization coefficient ratios can be made from such solutions. Figures 2, references 7: 6 Russian, 1 Western.
[266-6900]

UDC 621.382.2

INVESTIGATION OF LOCAL IRREGULARITIES IN PHOTOSENSITIVITY AND LUMINESCENCE OF CHALCOGENIDE LEAD FILMS IN SCANNING ELECTRON MICROSCOPE

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 18, No 3, Mar 83 (manuscript received 22 Jul 83; signed to press 24 Oct 83) pp 484-488

PETROV, V. I., PROKHOROV, V. A. and YUNOVICH, A. E., Moscow State University imeni M. V. Lomonosov

[Abstract] A method is described for investigating the photoelectric and luminescent properties of lead chalcogenide films in scanning electron microscopes. Local heterogeneities in the induced conductance and luminescence of polycrystalline PbS films are investigated and compared with oxygen localization regions on the surface. Methods of β-induced conductivity and cathode luminescence for investigating lead chalcogenide films are presented. The local connection between luminescent and dielectric properties is established from images of the same section of film. Electron irradiation of the films with the microscope operating in different modes resulted in changes in the properties. Coinciding areas of photosensitivity and strong cathode luminescence are shown to result from irregular oxidation of the films and to decrease in oxygen is desorbed. Figures 4, references 16: 11 Russian, 5 Western.
[266-6900]

UDC 621.315.592

COMPLEX FORMATION AND TEMPERATURE STABILITY OF ELECTROPHYSICAL PROPERTIES OF GaAs SEMIINSULATING SINGLE CRYSTALS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 18, No 3, Mar 84 (manuscript received 23 Jun 83; signed to press 15 Oct 83) pp 465-470

MARKOV, A. V., GRISHINA, S. P., MIL'VIDSKIY, M. G. and SHIFRIN, S. S., State Scientific Research and Design Institute of Rare Earth Metals Industry, Moscow

[Abstract] Single crystals of semiinsulating gallium arsenide grown on a layer of B_2O_3 (20-60 mm in diameter) with horizontally directed crystallization are investigated. It is found that annealing at temperatures below 900°C results in the formation of point defect complexes, but that complex formation is blocked in large regions about high temperature growth dislocations. Projection etching was used to establish that the annealing time for a given annealing temperature is significantly shorter for the bottom of the ingot than for the top. The complex formation rate is also higher in crystals that are grown rapidly. The connection between complex formation and variation in the electrophysical properties of the material is established; the influence of dislocations and the stability of the properties of heat treated crystals is investigated. Figures 5, references 10: 7 Russian, 3 Western.
[266-6900]

UDC 621.315.592

CONTRIBUTION OF DIFFERENT TRAPPING CENTERS TO POLARIZATION OF DIAMOND DETECTORS FOR IONIZING RADIATION

Leningrad FIZIKA I TEKHNIKA POLYPROVODNIKOV in Russian Vol 18, No 3, Mar 84 (manuscript received 20 May 83; signed to press 15 Oct 83) pp 460-464

MUKHACHEV, Yu. S., TATARINOV, V. S., BORZENKO, S. Yu., LIPOVCHENKO, A. L., KHRUNOV, V. S., MARTYNOV, S. S. and KUKUSHKIN, V. M., Scientific Research Institute of Applied Physics, Irkutsk State University imeni A. A. Zhdanov

[Abstract] The role of various deep trapping centers in processes underlying the formation of positive and negative space charges is analyzed, and the influence of the space charge on detector characteristics is determined. The trapping levels were investigated by the thermostimulated depolarization method. It was found that injected positive space charge occurs at deep levels which are manifested in thermostimulated depolarization currents as peaks with temperature maxima at 500-600 K. Diamond detectors are found to provide the required combination of concentrations of electron and hole trapping centers. Figures 3, references 11: 7 Russian, 4 Western.
[266-6900]

GROWTH RATE OF MICRODESTRUCTION SITES IN ALKALI HALIDE CRYSTALS CAUSED BY CO_2 LASER PULSES

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 2, Feb 84
(manuscript received 11 Jan 83) pp 323-326

KRUTYAKOVA, V. P. and SMIRNOV, V. N., Institute of Thermal Physics, Siberian Department, USSR Academy of Sciences

[Abstract] The growth rate of the sizes of sites of microdestruction is measured and investigated as a function of the time at which the laser pulse is initiated. It is found that the interaction of pulses from a CO_2 laser with radiation power density exceeding a critical value is accompanied by the formation of microscopic damage within alkali halide crystals whose dimensions and concentrations within the caustic of the focusing lens increase as the power density increases. The findings agree qualitatively with the results of an investigation of the growth kinetics of scattering associated with the formation of microdestruction. Figure 1, references 8: 6 Russian, 2 Western. [288-6900]

UDC 537.33

REVERSIBLE CHANGE IN PARAMETERS OF GaAs-BASED SURFACE-BARRIER METAL-SEMICONDUCTOR DIODES INDUCED BY HYDROGEN ABSORPTION-DESORPTION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 3, Mar 84
(manuscript received 27 Jul 83) pp 623-625

KULIYEV, B. B., SALAYEV, E. Yu. and SAFAROV, D. M., Azerbaijan State Pedagogical Institute imeni V. I. Lenin, Baku

[Abstract] A new type of hydrogen-sensitive surface-barrier metal-semiconductor diode based on Pd-GaAs in fabricated and investigated. The mechanism by which hydrogen interacts with the metal-semiconductor structure is analyzed. It is found that the current-voltage and capacitance-voltage characteristics of the Pd-GaAs diode are changed reversibly by the adsorption and desorption of hydrogen, and that the diode can be used as a high sensitivity hydrogen sensor. Reversible changing of the diode parameters expands the possibility of using such surface barrier devices. Figures 3, references 8: 1 Russian, 7 Western. [270-6900]

UDC 548.0+535.35

LOW-THRESHOLD STIMULATED EMISSION OF Nd^{3+} IONS IN $NaLuGeO_4$

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 3, Mar 84
(manuscript received 7 Jul 83) pp 599-602

KAMINSKIY, A. A., TIMOFEYEVA, V. A., BYKOV, A. B. and AGAMALYAN, N. R.

[Abstract] Generation of Nd^{3+} ions by stimulated radiation is detected at 300 K with a low excitation threshold on waves from two laser channels in an

active medium consisting of an $NaLuGeO_4$ crystal. The absorption-luminescent properties and parameters of $NaLuGeO_4$-Nd^{3+} are analyzed. Spectral-luminescent measurements are made. It is shown that $NaLuGeO_4$-Nd^{3+} crystals are promising for continuous lasing as well. Figures 3, references 8: 6 Russian, 2 Western.
[270-6900]

UDC 573.3

INVESTIGATION OF CRITICAL BEHAVIOR OF PERMITTIVITY OF HETEROGENEOUS MIXTURES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 3, Mar 84
(manuscript received 17 Jun 83) pp 590-592

VINOGRADOV, A. P., KARIMOV, A. M., KUNAVIN, A. T., LAGAR'KOV, A. N., SARYCHEV, A. K. and STEMBER, N. A., Institute of High Temperatures, USSR Academy of Sciences, Moscow

[Abstract] The permittivity of a pressed dielectric-metal mixture near the critical transition point is investigated. A mathematical model is developed for the behavior of the mixture, and the conductivity and permittivity are investigated as a function of frequency and of the content of mixture components. Technology is developed for fabricating metal-dielectric mixtures, and permittivities are measured. Figures 3, references 8: 2 Russian, 6 Western.
[270-6900]

THIN-FILM (Al,Ga)As HETEROJUNCTION SOLAR CELLS

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI Vol 10, No 8, 26 Apr 84
(manuscript received 22 Dec 83) pp 455-459

BRYNZAR', V. I., DOROGAN, V. V., IVANOV, M. B., TROFIM, V. G., CHUMAK, V. A. and CHEBAN, L. I., Kishinev Polytechnical Institute imeni S. Lezo

[Abstract] Properties of $pAl_xGa_{1-x}As$-nGaAs thin-film solar cells removed from GaAs substrates are investigated; the possibility of employing such cells as cascaded solar cells employing an Si cell as a narrow-band element is examined. Load characteristics and spectral photosensitivity distribution are examined for different types of cells. The development of high efficiency solar cells based on solid solutions of $Al_xGa_{1-x}As$ ($x \simeq 0.27$) makes it possible to obtain overall efficiency exceeding 30% in an AlGaAs/Si cascaded solar cell. Figures 2, references 5: 4 Russian, 1 Western.
[302-6900]

UDC 539.1.03

INTENSITY OF RADIATION DURING AXIAL CHANNELING OF HIGH ENERGY PARTICLES IN THICK CRYSTALS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 6, Apr 84
(manuscript received 11 Nov 83) pp 1369-1372

BAYYER, V. N., KATKOV, V. M. and STRAKHOVENKO, V. M., Institute of Nuclear Physics, Siberian Department, USSR Academy of Sciences

[Abstract] The optimum crystal thickness ensuring the greatest radiant energy yield for a given photon beam collimation is found. The distribution function in the phase space perpendicular to the direction of the axes is derived in asymptotic form which is valid for electrons as well as positrons and which describes uniform particle distribution in the transverse phase space. The reduction in energy due to radiation losses is analyzed. The case of supercritical energies is discussed. References 9: 3 Russian, 6 Western.
[297-6900]

UDC 537.311.33

NATURAL BIREFRINGENCE IN CUBIC CRYSTALS IN EXCITON REGION OF SPECTRUM

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 6, Apr 84
(manuscript received 4 Aug 83) pp 1404-1407

TSITSISHVILI, Ye. G., Moscow State University imeni M. V. Lomonosov

[Abstract] The effect of birefringence in crystals with zinc blende structure in the exciton region of the spectrum is analyzed theoretically. The states that are excited are identified as a function of the direction of polarization of light. Birefringence in crystals with cubic symmetry without an inversion center in the exciton region of the spectrum is found to result from anisotropy of the exciton bands and mixing of active states with triplet states. References 10: 6 Russian, 4 Western.
[297-6900]

UDC 626.378.325

IMPURITIES IN SILICATE GLASS AND DESTRUCTION OF GLASS BY STRONG RADIATION

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 46, No 4, Apr 84
(manuscript received 11 Oct 82) pp 627-632

NOVIKOV, N. P., IGNATENKO, K. I., MIKHAYLOVA, G. M., NOVIKOVA, N. N. and SHEVALEYEVSKIY, I. D., Moscow Geological Prospecting Institute imeni S. Ordzhonikidze

[Abstract] The role of admixtures in transparent dielectrics in the destruction process is investigated using specimens of natural quartz crystals, K-8

glass and quartz glass. The composition and amount of admixtures is analyzed by atomic absorption spectroscopy, spectral analysis, X-ray spectroscopy and electronic probe. The threshold values for glass and their relationship with external mechanical loads are determined. The number of subthreshold pulses in a destructive series is calculated as a function of the pulse parameters. Figures 2, references 12 Russian.
[290-6900]

STRONG-CURRENT HIGH SPEED COMMUTATOR BASED ON GaAs DYNISTOR STRUCTURE

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI Vol 10, No 7, 12 Apr 84
(manuscript received 23 Jan 84) pp 385-388

BOTIARYUK, V. M., VAYNSHTEYN, S. N., ZHILYAYEV, Yu. V. and LEVINSHTEYN, M. Ye., Physical-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences

[Abstract] GaAs-based dynistor structures are obtained by gas-phase epitaxy with good uniformity. A dynistor structure approximately 1 mm square is capable of commutating currents of up to 250 A. The use of a GaAs-based dynistor as a pulse modulator to drive a semiconductor heterolaser is illustrated. Low-voltage GaAs-based dynistor structures can be employed to produce an effective device for commutating currents of hundreds of amperes with engagement time not exceeding 200-300 ns, and for tens of amperes with engagement time approximately 50 ns. Figures 2, references 6 Russian.
[303-6900]

UDC 620.002:669-172:541.22

STOICHIOMETRIC SINGLE CRYSTALS AND REGION OF HOMOGENEITY OF REFRACTORY COMPOUNDS

Leningrad FIZIKA TVERDOGO TELA in Russian Vol 26, No 4, Apr 84
(manuscript rec eived 1 Dec 83) pp 1091-1094

GURIN, V. N., KORSUKOVA, M. M., KALASHNIKOV, Ye. V. and NIKANOROV, S. P., Physical-Technical Institute imeni A. Ioffe, USSR Academy of Sciences

[Abstract] The authors analyze conditions under which single crystals of refractory compounds with stoichiometric composition are synthesized. It is found to be impossible to obtain stoichiometric single crystals from the actual melt for most refractory compounds. Such single crystals can be obtained in most cases from solutions in melts of low-melting metals (such as aluminum, zinc, magnesium). Conditions are specified under which single crystals of stoichiometric composition can be synthesized. It is found that obtaining single crystals of refractory compounds of stoichiometric composition from the actual melt requires data on the position of the stoichiometry line; obtaining crystals by the solution method requires information regarding the

intersection of the line with one of the branches of the region of homogeneity at low temperatures, and about the presence of solid solutions between the solvent and crystallized compounds. Figures 4, references 5: 3 Russian, 2 Western.
[327-6900]

UDC 621.315.592

FORMATION OF LATTICE DEFECTS BY NITROGEN LASER EXPOSURE IN A_2B_6 SEMICONDUCTORS WITH WIDE FORBIDDEN BAND

Leningrad FIZIKA TVERDOGO TELA in Russian Vol 26, No 4, Apr 84
(manuscript received 20 May 83; revised 20 Oct 83) pp 995-1001

YABLONSKIY, G. P., Institute of Physics, Belorussian SSR Academy of Sciences

[Abstract] The influence of irradiating ZnSe, CdS, ZnTe, CdSe and CdTe crystals with LGI-21 and M-2000 nitrogen lasers on the intensity and photoluminescence spectra at 300, 77, and 4.2 K is investigated as a function of the power density and pulse repetition frequency. Structural defects are found to occur in the surface layer of A_2B_6 crystals that create radiative and nonradiative recombination centers changing the quantum yield and producing new bands in the photoluminescence spectra. The most probable mechanisms underlying the occurrence of defects is photo-amplified and recombination-amplified processes, as well as movement and propagation of dislocations. Figures 5, references 27: 19 Russian, 8 Western.
[327-6900]

UDC 621.378.325

LOW-THRESHOLD INJECTION LASERS ON GROWN GaInPAs/InP HETEROSTRUCTURES (1.2-1.6 μm WAVELENGTHS)

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 3, Mar 84
(manuscript received 31 Mar 83) pp 551-557

AVDEYEVA, V. P., BEZOTOSNYY, V. V., VASIL'YEV, M. G., DOLGINOV, L. M., DRAKIN, A. Ye., DURAYEV, V. P., YELISEYEV, P. G., MAL'KOVA, N. V., MIL'VIDSKIY, M. G., SVERDLOV, B. N., SKRIPKIN, V. A. and SHEVCHENKO, Ye. G., Institute of Physics imeni P. N. Levedev, USSR Academy of Sciences, Moscow

[Abstract] Injection lasers operating at 1.2-1.6 μm wavelengths are most desirable for optical communication systems operating at 1-2 GHz carrier frequencies, corresponding to maximum attainable rates and ranges of data transmission over optical fibers. Such injection lasers have been developed on GaInPAs/InP isoperiodic heterostructures. A grown buried-stripe configuration with the active layer in the form of a dielectric strip waveguide embedded in a material with lower refractive index has been found to be most nearly ideal.

Using a p-InP substrate offers optimum technological advantages, namely a most easily reproducible positioning of the p-n junction relative to the heteroboundaries, absence of a depletion region at the heterostructure surface with no leakage of Zn atoms from acceptor-doped upper layers, and adequacy of a linear low-resistivity contact layer adjoining the p-InP substrate instead of an otherwise required quaternary-compound contact layer. Such heterostructure were produced experimentally by 2-stage liquid-phase epitaxial growth, the p-InP substrates oriented in the (100) plane and doped with Zn to a concentration of 10^{18}-2.10^{18} cm^{-3}. The dislocation density did not exceed $3\ 10^{-4}$ cm^{-2}. The dislocation density did not exceed $3 \cdot 10^{4}$ cm^{-2} and in better specimens remained below 10^{3} cm^{-2}. In the first stage of the process, a 3-4 μm p-type emitter layer, a 0.1-0.3 μm pure active layer, and a 3 μm n-type emitter layer were grown. The emitter material was InP for shorter-wave lasers and GaInPAs for longer-wave lasers, with dielectric symmetry provided in each case. The second stage of the process involved photolithographic masking with 4-12 μm wide SiO_2 strips in the [110] direction and subsequent chemical etching of buried stripes down to the p-region so as to produce a stripe with upward widening "dovetail" cross section. The growth material here was InP for 1.3 μm lasers with 1.04-1.06 μm edge and GaInPAs for 1.5-1.6 μm lasers as well as for some 1.3 μm lasers. The p-n counterjunction for electrical isolation outside the active region was produced either by growing an n-type material and doping it with Zn by diffusion to the depth of the active layer, sometimes with the aid of an oxide film, or by growing alternately n-type and p-type layers with compensatory doping to reduce the concentration to $2 \cdot 10^{16}$ cm^{-3}. The performance of all these laser diodes was evaluated in terms of super-luminescence and evolution of their amplification spectra, emission spectra in the continuous-wave mode, power-current characteristic in continuous-wave mode and in pulse mode, dependence (linear) of threshold current on width of the active strip ranging from 1-2 kA/cm^2 at 1.3 μm wavelength to 2.5 kA/cm^2 at 1.5-1.6 μm wavelengths, temperature dependence (linear) of the threshold current, and degradation of performance with rising ambient temperature. Injection lasers of this kind with mode selection and transverse stabilization tend to emit radiation at a single frequency, with one longitudinal mode carrying 90% or more of the total emission power, which is very useful for high-resolution spectrometry.
Figures 8, references 22: 13 Russian, 9 Western.
[243-2415]

UDC 567.611.46

SYMMETRY OF EXCHANGE INTERACTION IN CRYSTALLINE MAGNETIC FILMS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 1, Mar 84
(manuscript received 20 Apr 83) pp 71-74

KOZHUKHAR', A. Yu.

[Abstract] Exchange interaction and its symmetry in epitaxial crystalline ferrite-garnet films were examined by the spin-wave-resonance method over a wide range of temperatures. Overlapping of wave functions of magnetically active

ions provides the mechanisms of such an interaction generally, and in this particular case electrical symmetry of octahedral and tetrahedral sublattices determines the symmetry. Films of $Y_3(FeGa)_5O_{12}$, 2.63-5.86 μm thick with axial symmetry, were grown epitaxially on gadolinum-gallium garnet with (111) orientation as substrate. Disks 1 mm in diameter were cut with polished lateral surface and etched back surface, their ferromagnetic resonance lines were $2\Delta H$= 0.50-0.80 Oe wide, their saturation magnetization was 4^- M= 1490 GS, and the mismatch of their lattice constants was $\Delta a = +9\ 10^{-3}$ Å. Spectra of spin-wave resonance were recorded with a high-resolution radiospectrometer in magnetic fields parallel or perpendicular to the normal to the film surface, at a typical frequency of 9.22 GHz at room temperatures, and the temperature dependence of splitting was measured at the same frequency over the 200-500 K temperature range. The data were used to calculate the exchange interaction energy. The results indicate that the exchange energy anisotropy is caused not by demagnetization but by elastic deformation of the film. This interpretation agrees with the model of anomalously differing exchange interaction constants based on domain structure and Curie temperature measruements. The author thanks N. I. Zotov for assisting in the study, B. P. Nam for supplying the specimens, and L. M. Letyuk for useful discussion of the results. Article was presented by Academician B. N. Laskorin on 20 April 1983. Figures 2, references 6: 1 Russian, 5 Western.
[245-2415]

UDC 548.0:532.787

PHOTOELECTRIC EFFECT IN LIQUID CRYSTALS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 1, Mar 84
(manuscript received 26 May 83) pp 60-63

VISTIN', L. K., Institute of Crystallography imeni A. V. Shubnikov, USSR Academy of Sciences, Moscow; KAZLAUSKAS, P.-A. V. and PAYEDA, S., Vilnius State Pedagogical Institute

[Abstract] An experimental study was made of the phtoelectric effect in nematic liquid crystals with intramolecular charge transfer and wide light absorption band, for the purpose of determining the effect of low-intensity illumination on the photoelectric properties of such crystals and particularly the photoconduction threshold in constant or low-frequency alternating electric fields. Measurements were made on ZhK-29 and ZhK-67 crystals consisting of a mixture of cyanobiphenyls and tolans. Specimens of 10 μm thick electrooptic cells with planar orientation and SnO_2 electrodes with 2 cm^2 surface area were assembled by a standard method. They were exposed locally to white light of a few mW/cm^2 power density. The cell resistance was measured with a Ye6-13 teraphmmeter. The resistance was found to depend on both intensity and spectral content of the light. The decrement of resistance under illumination was found to depend on the chemical composition of the crystal, being somewhat larger in ZhK-29 crystals than in ZhK-67. The test results reveal that the resistance decrement increases with better substrate surface finish and with higher degree of planar orientation. It varies with temperature, becoming maximum in an

isotropic melt. The resistance decrement in crystals pretreated in a weak constant electric field increases with increasing degree of polarization. The increase of photoconduction is attributed to dissociation of excited molecules and buildup of charge carrier concentration. The shape of a photo-emf coltage pulse is different in crystals of different compositions, its amplitude also depending on the constant bias voltage. Reverse bias causes first compensation and then reversal of photo-emf voltage polarity, the crystals having a long polarity "memory". Examination under an LYuMR-1 luminescence microscope has confirmed the local character of changes in the thresholds of electrooptic effects such as the Fredericks effect and EHD instability. The authors thank S. A. Pikin for helpful comments. Article was presented by Academician B. K. Vaynshteyn on 20 May 1983. Figures 3, references 12: 11 Russian, 1 Western. [245-2415]

UDC 548.0:535.37

MICROCATHODOLUMINESCENT STUDY OF PHASE INHOMOGENEITY IN YTTRIUM-ALUMINUM-GARNET SINGLECRYSTALS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 1, Mar 84 (manuscript received 8 Jun 83) pp 67-70

MEYL'MAN, M. L., GONCHAROV, S. M., BAGDASAROV, Kh. S., KEVORKOV, A. M., presented by academician B. K. VAYNSHTEYN, 30 May 83, State Scientific Research and Planning Institute of the Rare Metals Industry; All-Union Structural Engineering Correspondence Institute; Institute of Crystallography imeni A. V. Shubnikov, USSR Academy of Sciences, Moscow

[Abstract] The microcathodoluminescence spectra of YAG:Nd crystals, grown by directional horizontal crystallization in molybdenum containers, were studied using a JXA-3A electron probe microanalyzer equipped with a cathodoluminescence attachment. The spectral resolution of the optical system was improved through the use of an MM-101 monochromator with a set of diffraction gratings capable of a black dispersion 380 to 410 nm band of about 29 Å/mm. The sensitivity of the luminescence phase analysis of crystal inclusions was enhanved by applying conductive transparent layers of a composition of indium and tin oxides to the samples; this enabled the registration of no less than 85% of the exiting microcathodoluminescence emissions. This technique of exciting just an individual microinclusion in the sample and observing the emission from this region and scanning the exciting beam successfully reveals phase inhomogeneities in complex oxide single crystals, and determines both the structure of the inhomogeneities and their distribution over the sample volume. The data from the YAG:Nd studies demonstrate that it is possible to unambiguously identify the structure of microscopic inclusions even under unfavorable conditions, when the luminescence probe signal in the impurity phase is greatly attenuated as compared to the probe emission in the main material. It can be anticipated that similar studies of garnet phase inclusions in yttrium-aluminum-perovskite will be a much easier task, since at the usual activator concentration in this material of 1 to 2% there should be no suppression of the luminescence of garnet inclusions. Luminescence phase analysis techniques can play a significant part in the development of crystallization process theory for multicomponent systems as well as the refinement of production processes for growing large perfect crystals. Figures 2, references 15: 12 Russian, 3 Western. [229-8225]

UDC 537.8111

EXCITATION OF QUASI-STATIC MAGNETIC FIELDS WITH AXIAL STRUCTURE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 272, No 2, Sep 83 (manuscript received 3 Jan 83) pp 344-346

KARPENKO, A. G., LOBACHEVSKIY, L. A. and MIGULIN, V. V., Institute of Terrestrial Magnetism, the Ionosphere and Radio Wave Propagation, USSR Academy of Sciences, Moscow

[Abstract] Quasi-static magnetic fields generated in the air above the sea surface by AC with an insulated immersed branch and the water serving as a return are not dipolar as in a closed loop but have an axial structure. It is established that the magnetic field intensity in air is determined practically by the length of the submerged conductor alone. Experimental measurements were made for a field excited over the sea and coast by a current of 78 Hz and 25 A in a 200 m insulated conductor immersed to a depth of 1 m. A sharp and unexplained drop was observed at the land-sea boundary, the field intensity being relatively higher than the computed value before the discontinuity and relatively lower afterwards. The important feature is a law for intensity decrease with distance from the conductor which is D^{-3} for a closed loop and D^{-2} for the axial structure field and this could have practical importance since the effectiveness of axial field excitation with low and very low frequencies is significantly higher than that of dipolar fields. Figure 1. [221-12497

UDC 621.372.852.5

TRANSFORMATION OF HETEROGENEOUS SURFACE WAVES BY SKEWED STREAMS

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR: SERIYA A, FIZIKO-MATEMATICHESKIYE I TEKHNICHESKIYE NAUKI in Russian No 3, Mar 84 (manuscript received 24 Jan 83) pp 48-52

YEVDOKIMOV, A. P., Institute of Radiophysics and Electronics, Ukrainian SSR Academy of Sciences, Kharkov

[Abstract] Scattered electromagnetic fields arising as the result of interaction between the surface waves of a planar dielectric waveguide with a periodic structure consisting of a skewed reflecting lattice are investigated.

The radiating portion of the spectrum of the scattered field is shown to propagate from the plane containing the direction of propagation of the heterogeneous planar dielectric waveguide wave. There is found to be a critical angle at which the scattered field represents a heterogeneous electromagnetic wave propagating along the surface of the periodic structure. It is demonstrated possible to control the propagation direction for volume and surface diffraction waves in the structure in question. Figures 2, references 3 Russian.
[273-6900]

UDC 533.9

THEORY OF RADIO WAVE PROPAGATION OVER THE OCEAN

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 6, Apr 84 (manuscript received 9 Aug 83) pp 1372-1376

BUGROV, A. G., KLYATSKIN, V. I. and SHEVTSOV, B. M., Pacific Ocean Oceanological Institute, Far East Scientific Center, USSR Academy of Sciences

[Abstract] Radio wave propagation over an ideally conducting ocean is examined. The boundary value problems for the propagation of short radio waves in the earth's atmosphere are reformulated as problems with initial data more convenient for numerical analysis and statistical problem solving. The example problems are solved by integrating the Riccati equation and computing the quadrature. The case of finite conductivity can be analyzed analogously under the simplifying assumption that the atmosphere is a thin layer. References 4: 3 Russian, 1 Western.
[297-6900]

GAS DYNAMICS OF COMBUSTION OF GAS-AIR MIXTURE IN SEMI-CLOSED SPACE WITH RELIEF OF PRESSURE INTO GASLESS ADJACENT SPACE

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 1, Jan-Feb 84 (manuscript received 1 Mar 83; revised 14 Apr 83) pp 65-69

STREL'CHUK, P. A., MISHYYEV, A. V., NIKITIN, A. G. and ORAKHELASHVILI, N. V.

[Abstract] Experiments are conducted to provide a physical description of the processes occurring during the release of pressure from a gas-filled chamber into a gasless chamber when the holes connecting the first chamber to the atmosphere are small in order to ensure safe pressures when the mixture contained ignites. The gas dynamics of the combustion occurring in the two-chamber system is studied, and the basic factors influencing the process are identified. The model employed was a 100-liter cubic chamber divided in half by a barrier and communicating with the atmosphere through a hole. The gas employed was propane. The influence of the additional chamber on the way in which the pressure in the first chamber behaves is studied experimentally. It is found that the presence of an adjacent gasless compartment leads to sharp intensification of combustion in the two-chamber system, which is accompanied by alternating overflow of gases between the chambers, and that the combustion of the gas-air mixture in both chambers becomes highly turbulent. Figures 3, references 4: 1 Russian, 3 Western.
[276-6900]

UDC 533.92

VIBRATIONAL RELAXATION DYNAMICS IN RAPID-FLOW PLASMA CHEMICAL SYSTEMS

Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 18, No 2, Mar-Apr 84 (manuscript received 27 May 83) pp 151-158

KIRILLOV, I. A., POTAPKIN, B. V., RUSANOV, V. D., STRELKOVA, M. I. and FRIDMAN, A. A.

[Abstract] The dynamics of x-t-relaxation in subsonic flows of a gas with small Mach numbers is investigated with allowance for compressibility of the gas, as well as heat release associated with nonequilibrium chemical reactions. The oscillatory relaxation frequency is derived as a function of the initial Mach number, and the optimum flow parameters for accomplishing nonequilibrium plasma chemical reactions are determined. Figures 4, references 5 Russian.
[259-6900]

UDC 533.6.011.72:532.529

TRANSITION FROM REGULAR TO MACH REFLECTION DURING INTERACTION BETWEEN SHOCK WAVE AND SOLID WALL IN TWO-PHASE GAS-LIQUID MEDIUM

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian
No 5, Sep-Oct 83 (manuscript received 29 Mar 82) pp 190-192

VOLOSHINOV, A. V., KOVALEV, A. D. and SHINDYAPIN, G. P.

[Abstract] An equilibrium model allowing for the adiabatic velocity of sound is used to investigate reflection of the shock wave throughout the entire range of gas content. Nonlinear asymptotic expansions are used for the reflection of weak shock waves. The results for limiting cases agree with existing results for single-phase media. References 7: 4 Russian, 3 Western.
[258-6900]

UDC 532.516.5:529.2

ASSESSMENT OF INFLUENCE OF THREE-DIMENSIONAL EFFECTS ON DEVELOPMENT OF TRANSIENT CONCENTRATION NATURAL CONVECTION IN CLOSED REGION

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian
No 5, Sep-Oct 83 (manuscript received 12 Apr 82) pp 175-178

KOROLEVA, I. N., NIKULIN, D. A. and STRELETS, M. Kh.

[Abstract] The problem of transient concentration natural convection of a binary mixture of gases with an arbitrary finite ratio of densities in a closed rectangular heat insulating region is investigated with consideration of three-dimensional effects associated with the finiteness of the dimensions of the region. The flow is described by a system of equations representing the limiting form of a full system of Navier-Stokes equations. The analysis shows that the stronger the convection, the greater the error resulting from the assumption of a two-dimensional flow. Figures 3, references 5: 2 Russian, 3 Western.
[258-6900]

UDC 532.526.4

INFLUENCE OF DISTRIBUTED INJECTION OF POLYMER SOLUTION ON CHARACTERISTICS OF TURBULENT BOUNDARY LAYER

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian
No 5, Sep-Oct 83 (manuscript received 2 Jun 82) pp 58-64

ALEKSIN, V. A., MIKHAYLU, A. G. and PILIPENKO, V. N.

[Abstract] The movement of a plate during distributed injection of a polymer solution is examined on the basis of a system of partial differential equations.

It is shown that drag can be significantly reduced by injecting the solution in a distributed fashion. For example, the reduction in drag is 94% for a solution with a concentration of $3 \cdot 10^{-5}$ and $F = 2 \cdot 10^{-3}$. Calculations show that less polymer is needed to obtain the same reduction in drag when distributed injection is used. Figures 4, references 16: 9 Russian, 7 Western.
[258-6900]

ESTIMATION OF POTENTIAL PART OF PRESSURE BEHIND SHOCK WAVE FRONT

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 1, Jan-Feb 84 (manuscript received 20 Oct 82) pp 124-126

ANISICHKIN, V. A.

[Abstract] A method is proposed for analyzing the process of shock compression of a medium; the formula describing the connection between the "cold" compression and shock adiabatic curves is extended to the case of any solid substances. The minimum possible shock front width is determined; as the width increases, the compression becomes increasingly isentropic. It is found that the width of the front of a strong shock wave in a condensed medium exceeds the average intermolecular distance only slightly. Figures 2, references 3 Russian.
[276-6900]

CHARACTERISTICS OF INTERACTION OF EXPLOSIVE WAVES FROM SPHERICAL DEFLAGRATION WITH OBSTACLE

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 1, Jan-Feb 84 (manuscript received 18 Aug 82) pp 121-123

BYSTROV, S. A. and GOREV, V. A.

[Abstract] The difference in the behavior of explosive waves on an obstacle due solely to the profile characteristics are found. The maximum pressure of the positive phase of the wave and the wave momentum are taken to be identical. It is found that the maximum pressure drop and momentum in the positive phase of the wave must be known in order to assess correctly the interaction between explosive waves from gas deflagration and obstacles. Depending upon the duration of the wave and the relaxation time of the obstacle, it may be necessary to determine the entire profile of the wave. The direction in which to expect destruction can be judged by comparing the duration of the wave with the period of the natural oscillations of the construction. Figures 3, references 3: 2 Russian, 1 Western.
[276-6900]

INFLUENCE OF COMPOSITION OF COMBUSTIBLE GAS MIXTURE ON PARAMETERS OF PLANE SHOCK WAVE GENERATED DURING EXPLOSION IN AIR

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 1, Jan-Feb 84 (manuscript received 18 Feb 83) pp 90-93

VOYTOV, A. P., GEL'FAND, B. Ye., GUBIN, S. A., MIKHALKIN, V. N. and SHARGATOV, V. A.

[Abstract] The influence of the composition of a combustible mixture on the parameters of a plane shock wave in air generated by an explosion is investigated. The detonation wave is induced along the plane of symmetry; the shock wave begins to propagate after the detonation wave reaches the interface boundary in the air. The resulting nonstationary flow is described by unidimensional gasdynamic equations in lagrangian coordinates. The pressure at the front of a shock wave in air is computed as a function of the distance traveled by the shock wave. The nature of redistribution between internal and kinetic energy in air is discussed. Figures 3, references 7: 6 Russian, 1 Western.
[276-6900]

SHOCK WAVE PROPAGATION IN AIR SUSPENSION OF SOLID PARTICLES

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 1, Jan-Feb 84 (manuscript received 22 Feb 83) pp 86-90

GAVRILENKO, T. P. and GRIGOR'YEV, V. V.

[Abstract] Mechanical oscillations are employed to obtain a uniform concentration of solid particles in air suspension. Experiments to investigate shock wave propagation in the suspension produced are described. It is found that mechanical oscillations make it possible to obtain a uniform air suspension with the required concentration in channels approximately one meter long. The approximate model employed describes the attenuation of a nonstationary shock wave accurately enough for practice. The discrepancy in the analytical data does not exceed 20% up to Mach numbers of m=2. Figures 3, references 7: 5 Russian, 2 Western.
[276-6900]

TRANSITION FROM EXPLOSION TO DETONATION IN POROUS EXPLOSIVES

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 1, Jan-Feb 84 (manuscript received 11 Oct 82; revised 30 Nov 82) pp 70-77

AKHATOV, I. Sh. and VAYNSHTEYN, P. B.

[Abstract] Possible mechanisms underlying the smooth and explosive transition modes in a porous model explosive, or high-calorie powder, are investigated. It is found that if the work performed by the forces of the intergranular

pressure goes entirely to heating of the gas, there is a smooth transition from combustion to detonation of porous explosives. If some of the work is transformed to internal particle energy (elastic or thermal), explosive transition occurs. The explosive transition from combustion to detonation is discussed. Figures 6, references 14: 10 Russian, 4 Western.
[276-6900]

UDC 532.511

DEVELOPED TURBULENT FLOW UNDER CONDITIONS OF INTERNAL AND EXTERNAL PROBLEMS

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 1, Jan 84
(manuscript received 4 Jan 83; revised 26 May 83) pp 171-173

GALIMZYANOV, R. F., Ufa Aviation Institute imeni Sergo Ordzhonikidze

[Abstract] The development of a turbulent flow in a flat diffuser with boundary layers closed at the inlet is analyzed. Sequential approximation is used to solve the Prandtl equations for the region near the wall, and integral methods are used for the external region. The analytical and experimental findings are compared. Figure 1, references 6 Russian.
[197-6900]

INTERFEROMETRIC INVESTIGATION OF ESCAPE OF VISCOUS GAS FROM SLOT AND CYLINDRICAL CHANNELS INTO SPACE WITH LOW PRESSURE

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 1, Jan 84
(manuscript received 29 Mar 82; revised 22 Sep 82) pp 146-154

MASLENNIKOV, V. G., Physical-Technical Institute imeni A. F. Ioffe, Leningrad

[Abstract] The change in the flow structure in the channel and jet are investigated as the relative length of the channel and stream retarding temperature are varied over the range of Reynolds numbers from $5 \cdot 10^4$ to $1.5 \cdot 10^6$. The density distribution in the channel and the escaping jet are recorded by means of a polarized interferometer with a giant-pulse ruby laser as the light source. Figures 6, references 12 Russian.
[197-6900]

UDC 626.8:62-553

HYDRODYNAMIC LOADS ON GATES IN AUTOMATIC ANTIFLOODING SYSTEM

Frunze IZVESTIYA AKADEMII NAUK KIRGIZSKOY SSR in Russian No 1, Jan-Feb 84 pp 12-15

MAKOVSKIY, E. E. and SKOROKHODOVA, L. N.

[Abstract] The results of full-scale investigations of the operating conditions of the hydromechanical equipment serving the pneumohydraulic regulators in a water intake assembly in the Alamedin River are described. The water intake arrangement employs two systems for stabilizing the head race. The installation and calibration of the sensors employed is described. The pressure against the upstream face of the gate was measured with the gates wide open. An analytical method is recommended on the basis of the data gathered. Figures 5, references 2 Russian.
[296-6900]

UDC 536.24.533.6.011.6

INVESTIGATION OF SCREENING OF RADIATION THERMAL FLUX BY INJECTION OF PRODUCTS OF DESTRUCTION OF ASBESTOS PLASTIC IN HYPERSONIC FLOW AROUND SPHERE

Minsk INZHENERGO-FIZICHESKIY ZHURNAL in Russian Vol 46, No 2, Feb 84 (manuscript received 5 Sep 82) pp 303-308

GUDZOVSKIY, A. V. and KONDRANIN, T. V., Moscow Physical-Technical Institute

[Abstract] The principles of screening of a radiation flow by laminar and turbulent boundary layers on the frontal surface of a sphere are investigated parametrically and analyzed physically. The results of systematic calculations of radiative-convective heat exchange over a significant portion of the frontal surface of a sphere in a hypersonic flow of 98% CO_2 plus 2% N_2 are presented. The variation in the screening coefficient along the generator and the influence of the flow conditions in the boundary layer are examined. References 11: 8 Russian, 3 Western.
[305-6900]

UDC 532.516

EXPERIMENTAL INVESTIGATIONS OF DEVELOPING FLOW IN SQUARE CHANNEL ROTATING ABOUT TRANSVERSE AXIS

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 45, No 4, Oct 84 (manuscript received 5 Nov 82, synopsis received 18 Apr 83) pp 662-663

[Synopsis of article by A. V. Kuz'minskiy, Ye. M. Smirnov and S. V. Yurkin, deposited in the All-Union Institute of Scientific and Technical Information, 23 May 83, registration No 2765-83 Dep.]

[Abstract] Hydrogen bubbles are employed to study the velocity field in a laminar flow of water through a rotating channel under widely differing input conditions. Investigation of the time lines indicates that the fundamental effect of the Coriolis force shows up strongly for the modes investigated, with the nucleus of the stream having uniform velocity distribution along the lines parallel to the axis of rotation. Rotation is found to shorten the length of the initial flow section in the channel. References 12.
[312-6900]

UDC 532.517

LAMINAR-TO-TURBULENT FLOW TRANSITION UNDER INFLUENCE OF ACOUSTIC OSCILLATIONS

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 45, No 4, Oct 83 (manuscript received 30 Nov 81) pp 560-563

SHEL'PYAKOV, A. N., KASIMOV, A. M. and ISUPOV, G. N., Votkinsk Evening Branch, Izhevk Mechanical Institute

[Abstract] Flow visualization with a smoke generator is employed to study the aerodynamic processes occurring during the transition between laminar and turbulent flow. Two conical flows are observed to form in the transitional segment between laminar and turbulent flows subjected to acoustic oscillations produced by a piezocrystal. The findings demonstrate the existence of acoustically differing sections within the laminar flow and a significant difference in the transition from laminar to turbulent flow caused by transverse flow and acoustic oscillations. Figures 3, references 3 Russian.
[312-6900]

UDC 532.529.5

PROPAGATION OF GAS JET IN LIQUID

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 45, No 4, Oct 83 (manuscript received 5 May 82) pp 542-554

SURIN, V. A., YEVCHENKO, V. N. and RUBIN, V. M., Leningrad Mechanical Institute

[Abstract] The dynamics of a gas jet in a liquid is investigated experimentally in order to identify the interaction mechanism in the gas-liquid system and to assess the influence of the degree of gas assimilation on the interaction, to

investigate the structure and dynamics of the region of interaction, to discover the modes of gas jet escape from a submerged nozzle and to construct a dynamic model of the region of interaction with allowance for different gas assimilation. Hydrodynamic instability is shown to play a determining role. Figures 4, references 28: 26 Russian, 2 Western.
[312-6900]

UDC 532.526

PROBLEM OF REDUCTION TO IDEAL WIND TUNNEL IN EXPERIMENTAL AERODYNAMICS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 274, No 6, Feb 84 (manuscript received 22 Sep 83) pp 1309-1312

YANENKO, N. N., academician [deceased], VOSKOBOYNIKOV, Yu. Ye. and PREOBRAZHENSKIY, N. G., Institute of Theoretical and Applied Mechanics, Siberian Department, USSR Academy of Sciences, Novosibirsk

[Abstract] Reduction to an ideal wind tunnel is necessary in experimental aerodynamics for elimination of the instrument error which, in the case of a wind tunnel, results from distorting stochastic perturbations caused by the flow of air. In accordance with the entirely plausible linear model, the process actually measured and recorded is the sum of the principal streamlining process, an interference process not associated with streamlining and occurring beyond the zone of stream perturbation by the immersed body, and a noise process in the measuring and recording instruments. Assuming that the principal process and the sum of the two others are mutually independent, a Volterra integral equation of the first kind is derived for their probability distribution densities in a way that makes it possible to separate and exclude the instrument function characterizing the wind tunnel. The experiment thus becomes reduced to one in an "ideal" wind tunnel without interference. The corresponding problem for this equation is mathematically ill-conditioned and must be regularized before it can be solved, preferably by numerical experiment. Finiteness of interference and noise probability distribution densities, differenceness of its kernel, and inaccuracy of both its kernel and right-hand side have been taken into account in the algorithm of its solution. The procedure is demonstrated on evaluation of the emplitude distribution density of fluctuations in a turbulent stream flowing through a wind tunnel. Figures 2, references 7: 5 Russian, 2 Western.
[228-2415]

EXPERIMENTAL STUDY OF MACH REFLECTION OF WEAK SHOCK WAVES

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 3, Mar 84
(manuscript received 3 Mar 83) pp 625-628

MAKAREVICH, G. A., LISENKOVA, G. S., TIKHOMIROV, N. A. and KHODTSEV, A. V.

[Abstract] An experimental study was made of Mach reflection of weak shock waves, shock waves of near acoustic intensity, for the purpose of determining the dependence of pressure in the reflected wave along the wall on parameters of the incident wave: its Mach number and its angle with the wall. Measurements were made in a wind tunnel of swuare (250 x 250 mm) cross section and 2 m long, connected at one end to a cubical (0.5 x 0.5 x 0.5 m) test compartment and at the other end through a dielectric transition piece to a cylindrical electric-discharge chamber. A cruciform gas duct feeding into the discharge chamber facilitated distributing the generated plasma uniformly over the tunnel cross section. Pressure measurements were made with two sets of transducers, smaller ones with pickup membranes 4 mm in diameter and larger ones with pickup membranes 20 mm in diameter, all having intrinsic capacitance of approximately 500 pF and sensitivity of 0.3 W/atm with vibration immunity within 0.001 atm/g (acceleration). Calibration of instruments during measurements minimized errors due to gain instability while extending the linear range of their characteristics and reducing the effect of electromagnetic interference. The diffraction pattern was photographed by the straight-shadow method. The ratio of pressure pulse amplitude at the wavefront to pressure pulse amplitude behind the wave was found to peak at an incidence angle within 50-60° and then to drop to zero at a 90° incidence angle (normal incidence), remaining quite high over the 0-50° range of incidence angles. Statistical analysis of the results using Student's t-test yielded a semi-empirical algebraic relation between the pressure rise due to reflection, as function of the incidence angle and the Mach number. As the incidence angle exceeds its critical magnitude, reflection ceases to be regular and becomes nonregular with the pressure in the reflected wave along the wall decreasing monotonically until it becomes equal to the pressure in the incident wave, regardless of the latter's intensity, when the incidence angle is 90°. Theoretical and experimental data on nonregular reflection of weak shock waves agree closely for incidence angles near the critical only, their discrepancy widening as normal incidence is approached. The results of this study supplement results obtained elsewhere on Mach reflection of strong shock waves and on transient interaction of shock waves. Figures 2, references 9 Russian.
[243-2415]

UDC 534.222.2+53.0.82.7+537.311.37+537.56

ELECTRICAL CONDUCTIVITY PROFILES IN GASES DURING DETONATION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 1, Mar 84
(manuscript received 19 Apr 83) pp 74-79

PINAYEV, A. V. and SYCHEV, A. I., Institute of Hydrodynamics imeni M. A. Lavrent'yev, Siberian Department, USSR Academy of Sciences, Novosibirsk

[Abstract] The electrical conductivity behind a detonation front in explosive gas mixture was measured with a special probe in shock tubes consisting of two

stainless steel segments separated by 0.1 mm thick insulating Teflon spacer rings. Both tubes had a 17.5 mm inside radius, one was 2.7 m long and one was 4.5 m long, an electrically insulated stainless steel wire with a 1, 2, or 3 mm radius running along the axis and a copper wire with a 2 mm radius electrically connecting the two isolated halves. The time derivatives of current di/dt in this copper conductor during propagation of a detonation wave along the second half of a tube was measured with differentiating magnetic transducers, ferrite rings of M 300 NN-3 and M 600 NN-8 material wound with 10-350 turns of wire (n= 10 turns corresponding to a load resistance of 10 ohms and a time constant of 0.2 μs). The tubes, after evacuation, were filled with H_2+ xO_2 (x= 1/2, 1) or C_2H_2 + yO_2 (y= 1, 5/2, 5) mixtures to pressures of 0.1-2.5 atm. The gases used for these mixtures contained 99.7%O_2, 99.9%H_2, 99% C_2H_2. The mixtures were ignited by a high-voltage discharge, transition from combustion to detonation within the first half of a tube was accelerated by means of a turbulizer. The probiles of pressure, belocity, and flow rate were almost the same with and without electrode wire in the tube. The conductivity readings and oscillograms did not depend on the radius of the center (axial) electrode, no thermionic emission of electrons occurred at the metal surface of the tubes during measurements. The experimental data reveal a cellular wave structure at low pressure and an attendant oscillatory conductivity profile that remains flat for a long time before peaking in H_2+ xO_2 mixtures and that peaks narrowly immediately at the wavefront in C_2H_2+ yO_2 mixtures. The sharp peaking of the conductivity at the front of a detonation wave and the smooth increasing of the conductivity (and the electron concentration) behind the front of a shock wave are interpreted theoretically as characterizing an ideal cold plasma, this difference in behavior being attributed to the effect of exothermic chemical reactions on the ionization process according to the Chapman-Jouguet detonation model with thermal (equilibrium) ionization in hydrogen-oxygen mixtures or dissociative (nonequilibrium) recombination in acetylene-oxygen mixtures. Article was presented by Academician S. S. Kutateladze on 11 April 1983. Figures 3, references 13: 7 Russian, 6 Western. [245-2415]

UDC 621.375.826

NUMERICAL ANALYSIS OF PARAMETERS OF SELF-HEATING COPPER VAPOR LASERS

Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 21, No 5, Sep-Oct 83 (manuscript received 19 May 82) pp 976-981

GALKIN, A. F., KLIMOVSKIY, I. I., and SELEZNEVA, L. A., Institute of High Temperatures, USSR Academy of Sciences

[Abstract] Numerical analysis is employed to find operating modes of self-heating copper vapor lasers with discharge tubes of different diameters, in which the coefficient of conversion of the discharge input energy to lasing energy and the average lasing power are near maximum. The optimum buffer gas pressure, discharge tube diameter, pulse recurrence rate and excitation pulse length are analyzed. The results of various studies on the optimum excitation pulse recurrence rate are compared, and the causes for reduced lasing power over time are identified. Figures 6, references 19: 16 Russian, 3 Western. [268-6900]

UDC 621.373.8

248 nm - NEW SHORT WAVELENGTH FOR PUMPING LASERS EMPLOYING VAPORS OF COMPLEX MOLECULES

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 27, No 4, Apr 84 (manuscript received 6 Jun 83) pp 118-119

GRUZINSKIY, V. V., DEGTYARENKO, K. M., KOPYLOVA, T. N. and PAVLOVA, V. T., Siberian Physical-Technical Institute imeni V. D. Kuznetsov, Tomsk State University, Belorussian Polytechnical Institute

[Abstract] Lasing at λ-248 nm is achieved in an excimer laser by increasing the stability of the excited molecules by using an outside gas and a compound in which the quantum yield changes little as the stored vibrational energy increases. Pentane was used in the first case, and perylene in the second. The fluorescence spectra of pure vapors of POPOP and perylene are presented. Different classes of organic compounds with which lasing at λ=248 nm is achieved are presented. The lasing with vapors of organic compounds exicted

by high energy light quanta indicates the possibility of lasing with complex molecules in the short wave ultraviolet region of the spectrum, as well as the efficiency of transforming the powerful radiation from excimer lasers to the near ultraviolet and visible portion of the spectrum. Figures 2, references 10 Russian.
[286-6900]

USE OF ALKALI HALIDE CRYSTAL COLOR CENTERS FOR PASSIVE MODE LOCKING OF YAG:Nd LASERS

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 6, 26 Mar 84 (manuscript received 26 Apr 83; revised 13 Feb 84) pp 357-359

DEMCHUK, M. I., MIKHAYLOV, V. P., SOBOLEV, L. M., PENZINA, E. E., PARFIANOVICH, I. A., MAKUSHEV, K. A., GILEV, A. K. and BRYUKVICH, V. V., Scientific Research Institute of Applied Physical Problems, Belorussian State University, imeni V. I. Lenin

[Abstract] The use of alkali halide crystals containing Z-color centers in passive shutters of YAG:Nd lasers is discussed. It is demonstrated possible to use such crystals as passive chutters for mode locking of lasers operating in the near IR range: these crystals provide ultrashort pulses with duration of 45 ps and energy of 0.2 mJ, which is comparable to the characteristics of ultrashort pulses provided by commonly used dyes. Figure 1, references 3 Russian.
[267-6900]

UDC 621.378.3

TUNABLE DYE LASER PRODUCING SINGLE ULTRASHORT PULSE

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 2, Feb 84 (manuscript received 24 Sep 82) pp 330-333

MIRADYAN, L. Kh., OGANESYAN, M. K., PAPAZYAN, T. A., SARKISYAN, S. M. and KHACHATRYAN, R. Zh.

[Abstract] The characteristics of a picosecond distributed feedback laser that generates single ultrashort pulses are investigated. Two-stage amplification provides high tunable laser output power in a multifrequency lasing mode. The experimental setup is described, and the lasing spectrum is analyzed phtometrically. Single-frequency and multi-frequency lasing modes are investigated; it is found that intensities at different wavelengths can be varied by changing the orientation of the mirrors in the device. Figures 3, references 6: 5 Russian, 1 Western.
[277-6900]

UDC 621.378.325:536.24

THERMAL EFFECT OF LASER RADIATION ON LAYERED TISSUES OF THE EYE

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 2, Feb 84
(manuscript received 11 Jun 82) pp 207-211

PODOL'TSEV, A. S. and ZHELTOV, G. I.

[Abstract] A comparison is made between the calculated and experimental results of direct measurements of heating of the retina by laser radiation. The proposed method takes into account the actual thermophysical properties of the individual layers of the eye, in contrast to other thermal models employed. The proposed mathematical model and analytical program can also be used to determine temperatures in other partially-absorbing layered media oriented perpendicular to the beam, as long as their radial dimensions are greater than the diameter of the laser beam. Figures 4, references 7: 2 Russian, 5 Western.
[277-6900]

UDC 621.373.535

HIGH-EFFICIENCY CHROMIUM-YTTERBIUM-ERBIUM PHOSPHATE GLASS LASER

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 2, Feb 84
(amnuscript received 29 Oct 82) pp 189-194

BEREZIN, Yu. D., DANIL'CHUK, N. V., LUNTER, S. G., MIT'KIN, V. M., FEDOROV, YU. K. and SHANPOVALOV, V. N.

[Abstract] The use of trivalent chromium as a sensitizing agent in phosphate glasses activated with ytterbium-erbium is described. The use of trivalent chromium to sensitize phosphate ytterbium-erbium glasses with a concentration of 0.08% Cr_2O_3 by weight lowers the lasing threshold by a factor of about 1.7, increases efficiency by a factor of 2 or 3, and nearly doubles the average radiated power. Chromium-ytterbium-erbium glass has the disadvantage of high heat release and difficulty of controlling homogeneity in the visible region of the spectrum. Figures 3, references 20: 14 Russian, 6 Western.
[277-6900]

UDC 621.375.8

TUNABLE LASERS AND LASER SPECTRAL DEVICES EMPLOYING ACOUSTICOOPTICAL FILTERS

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 2, Feb 84
(manuscript received 29 Oct 82) pp 181-189

STEL'MAKH, M. F., DMITRIYEV, V. G., MIKHAYLOV, L. K., SEREGIN, S. L., SPITSYN, Ye. M. and CHEREDNICHENKO, O. B.

[Abstract] A review is given of research and developmentn on dye lasers employing acousticooptical filters, as well as spectral and analytical equipment based on dye lasers: laser spectrophotometers and atomic fluorescent spectrometers.

The basic formulas describing the operating principles of dye lasers with acousticooptical filters are presented, along with typical spectral characteristic values and the possibilities of controlling wavelength, line width and radiated power. It is found that laser atomic fluorescent spectrometers can be employed for trace element analysis of agricultural sites, for environmental protection and for a number of scientific and engineering problems. Laser spectrophotometers give qualitatively new information about investigated objects in a number of applications. Figures 4, references 9: 5 Russian, 4 Western.
[277-6900]

SELF-MODULATION OF INJECTION LASER EMISSION INTENSITY DUE TO EXTERNAL OPTICAL FEEDBACK

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 1, Jan 84 (manuscript received 26 Apr 83) pp 198-200

SMIYAN, B. I., TREGUB, D. P. and ELENKRIG, B. B., Institute of Electrical Engineering and Electronics, USSR Academy of Sciences, Moscow

[Abstract] Low frequency oscillations in the radiation intensity of injection lasers caused by the introduction of optical feedback are investigated on a dual $Al_xGa_{1-x}As$-GaAs buried-stripe heterolaser producing several spatial modes at $\lambda \sim 0.86$ um. The experimental setup is described, and the oscillations in intensity of the laser radiation are analyzed and found to be of two types: sinusoidal high frequency oscillations with frequencies F_0, F_1, etc., and low frequency relaxation-type oscillations with frequencies f. Figures 2, references 5 Western.
[197-6900]

UDC 621.373.826.038.823

LASER PROCESSING OF OBJECTS WITH SIMULTANEOUS VISUAL MONITORING IN COPPER-VAPOR LASER-AMPLIFIER SYSTEM

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84 (manuscript received 8 Aug 83) pp 418-421

ZEMSKOV, K. I., KAZARYAN, M. A., MATVEYEV, V. M., PETRASH, G. G., SVMSONOVA, M. P. and SKRIPNICHENKO, A. S., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] The findings from experiments using a laser-amplifier system for microprocessing of objects, providing simultaneous visual monitoring, are presented. The working wavelength of the copper-vapor laser-amplifier was 510.5 nm. Analysis of the processing of metal-films on a dielectric substrate shows that the system is promising for scientific and practical devices, especially when an intensity distribution with an assigned complex configuration must be formed at the input of the amplifier. Figures 5, references 6: 5 Russian, 1 Western.
[252-6900]

UDC 621.373.826.038.823

INVESTIGATING OF MIXING D_2-CO_2-GDL

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2, (140), Feb 84
(manuscript received Apr 83) pp 400-402

ALEKSEYEV, K. P., GORSHUNOV, N. M., MYASNIKOV, A. N. and NESHCHIMENKO, Yu. P.,
Moscow Engineering-Physical Institute

[Abstract] The first experimental findings from an investigation of a thermally initiated mixing type D_2-CO_2-GDL are presented. The deuterium was heated by a pulsed electrical discharge in a truncated cylindrical hot pressure chamber. The time behavior of small-signal is investigated, and the stored laser energy in the GDL channel was calculated. No significant relaxation losses of vibrational energy are noted when CO_2 molecules are added to the supersonic deuterium stream. References 4: 3 Russian, 1 Western.
[252-6900]

UDC 621.373.826.038.823

INFLUENCE OF TRANSLATIONAL AND HYPERFINE RELAXATION ON ENERGY CHARACTERISTICS OF OXYGEN-IODINE LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84
(manuscript received 25 May 83) pp 382-385

ZAGIDULLIN, M. V., IGOSHIN, V. I. and KUPRIYANOV, N. L., Kuybyshev Branch,
USSR Academy of Sciences Institute of Physics

[Abstract] The influence of translational and hyperfine relaxation on the energy characteristics of chemical oxygen-iodine lasers is investigated. In the model, a homogeneous stream of oxygen, atomic iodine, argon and extinguishing impurities moves in a uniform velocity in a flat Fabry-Perot resonator. It is found that relatively low quenching rates at pressures of 1-5 mm Hg can cause a two-fold drop in the laser power. The results obtained are for single-mode lasing realized in resonators with short optical length. The nonuniform broadening and finite relaxation times noted must be taken into account in the practical development of chemical oxygen lasers and in the numerical modeling of lasing kinetics. Figures 2, references 14: 6 Russian, 8 Western.
[252-6900]

UDC 621.375.8.038.825.4

DUAL (GaAl) As-HETEROSTRUCTURE BASED INJECTION LASER TRAVELING WAVE AMPLIFIER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84
(manuscript received 16 Mar 83) pp 375-381

GONDOBIN, I. S., LUK'YANOV, V. N., SOLODKOV, A. F., TABUNOV, V. P. and YAKUBOVICH, S. D., All-Union Scientific Research Institute for Optical and Physical Measurements

[Abstract] The stationary transfer characteristics and transients at heterostructure laser amplifiers are calculated on the basis of an emperical model that satisfies spontaneous emission of heterolasers at room temperature. Direct measurements of the physical parameters are made when narrow-band optical signals from an external source are input. Maximum gain of 26 dB was observed, with output signal to background ratio of 7 dB with no spectral selection, and 24 dB using an output filter with passband of 0.1 nm. The experimentally measured parameters confirm the promise of laser amplifiers for the development of new types of fiber optic communications line. Figures 5, references 7 Russian.
[252-6900]

UDC 621.375.8.038.823

TRANSIENT OPTICAL NUTATION IN CO_2 LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84
(manuscript received 12 Apr 83) pp 344-348

BARANOV, V. Yu., BORZENKO, V. L., KOZOCHKIN, S. M., MAKAROV, K. N., MALYUTA, D. D., PETRUSHEVICH, Yu. V., SATOV, Yu. A., STAROSTIN, A. N. and STREL'TSOV, A. P.

[Abstract] The influence of coherent effects on amplified pulse shape is examined in detail for high pulse energy density, maximum possible gain-length product and high energy contrast of input signal employing equipment with approximately 0.15 ns temporal resolution. The experimental setup and measurement method are described. It is shown that the effects of coherent interaction of a light pulse with the ambient medium can influence the form of radiation in power amplifier stages where the leading edge of the pulse is approximately 0.1 ns long and the energy density is approximately 1 J/cm^2. The observed effect is interpreted as causing oscillographically observed oscillations in pulse intensity. Figures 4, references 10: 7 Russian, 3 Western.
[252-6900]

UDC 535.211

OPTICAL RECORDING OF INFORMATION ON PAPER BY CO_2 AND YAG-LASERS

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84
(manuscript received 8 Apr 83) pp 339-344

BAYEV, S. G., BESSEML'TSEV, V. P., KORONKEVICH, D. V. and TKACHUK, Yu. N., Institute of Automation and Electrometry, Siberian Department, USSR Academy of Sciences, Moscow Polygraphic Institute

[Abstract] This study presents the results of an investigation of methods for outputting information from computers that have the advantages of typographic printing processes, but are distinguished by the lack of an intermediate medium. Methods for recording graphic and half-tone images are investigated that are based on layers of ink deposited on the paper in advance, as well as fixing a temperature-sensitive dye on the paper by using a focused laser beam with radiation power density of 10^6 W/cm^2 to heat the surface. IR process lasers provide good efficiency and resolution. Figures 7, references 6: 3 Russian, 3 Western.
[252-6900]

UDC 621.373.826.038.823

DISTRIBUTION OF ELECTROMAGNETIC FIELD AND GAIN IN FLAT RESONATOR OF CO_2 GDL WITH LARGE FRESNEL NUMBERS

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84
(manuscript received 18 Mar 83) pp 262-268

BUTKOVSKIY, A. V. and DYNNIKOVA, G. Ya.

[Abstract] The influence that variation in the characteristic lengths of the exchange and relaxation processes occurring in an inversely populated CO_2-N_2-H_2O medium has on the field distribution in the modes of a flat resonator at large Fresnel numbers is investigated. Characteristics of the limiting geometric distribution associated with the presence of a high speed active medium, which do not occur in solid state lasers, are examined. A four-temperature kinetic model is used. The intensity and gain distribution obtained are compared with the results of calculations using a model developed elsewhere. When the equivalent Fresnel number is high enough, modes with near geometric optical intensity distribution have a minimum in the same distribution along the stream. Figures 8, references 15: 13 Russian, 2 Western.
[252-6900]

UDC 621.373.826.038.823

INVERSION ACCUMULATION IN ACTIVE MEDIUM OF IODINE LASERS IN PRESENCE OF IRREGULAR MAGNETIC FIELDS

Moscow KVANTOVAYA ELEKETRONIKA in Russian Vol 11, No 2 (140), Feb 84 (manuscript received 17 Mar 83) pp 257-261

BOBROV, B. D., KISELEV, V. M. and GRENISHIN, A. S.

[Abstract] The stored specific energy density in an iodine laser in external magnetic fields is estimated with allowance for the hyperfine structure of levels and the characteristics of the Zeeman effect. The energy density stored in the active medium of the laser in an irregular longitudinal magnetic field can be as high as several joules per square centimeter of active body. The theoretical relationships are tested experimentally on a laser with an active body 1 m long and 20 cm in diameter. The relationships presented for the amplification cross section can be used in developing variable-transmission iodine shutters in which absorption is controlled by a transient irregular field formed in the cell by a system of external solenoids. Figures 3, references 9: 8 Russian, 1 Western.
[252-6900]

UDC 621.373.826

SOLAR-PUMPED LASERS (A REVIEW)

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84 (manuscript received 31 May 83) pp 233-257

GOLGER, A. L. and KLIMOVSKIY, I. I., Institute of High Temperatures, USSR Academy of Sciences

[Abstract] A comparative analysis of various gas and solid state solar pumped lasers is presented. The review includes photodissociation solar pumped lasers, solar pumped laser systems employing ideal black body coatings or devices to absorb solar radiation, and solar pumped solid state lasers. The maximum efficiency, optimum transverse dimensions of the active medium and required solar energy concentration for solar pumped lasers are tabulated. Most laser arrangements can provide, under optimal conditions, maximum efficiency at the 3-5% level; however, all solar pumped lasers that have been developed to data have efficiency significantly lower than 1%. Figures 8, references 52: 31 Russian, 21 Western.
[252-6900]

UDC 621.373.826.038:825.4

SPECTRALLY MATCHED MODULATION OF RADIATION OF INJECTION LASER IN TRAVELING-WAVE AMPLIFIER BELOW 2 GHz

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84 (manuscript received 21 Sep 83) pp 231-232

ANNENKOV, D. M., BOGATOV, A. P., YELISEYEV, P. G., OKHOTNIKOV, O. G., PAK, G. T., RAKHVAL'SKIY, M. P., FEDOROV, Yu. F. and KHAYRETDINOV, K. A., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] An AlGaAs laser is modulated by modulating the pumping current of a traveling wave emplifier. The experimental setup employs a single-frequency laser with an external dispersion resonator as a master oscillator. The optical spectrum width did not exceed twice the frequency of the modulating signal. Spectrally matched modulation minimizes the dispersion spreading of the light pulse, and implements special multiplexing of optical communications channels practically up to the theoretical limit. Figures 2, references 5: 1 Russian, 4 Western.
[252-6900]

UDC 621.378.3

OPTIMIZATION OF ULTRASHORT PULSE GENERATION MODE OF YAG LASER

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian Vol 48, No 3, Mar 84 pp 583-586

DEMCHUK, M. I., MIKHAYLOV, V. P. and CHERNYAVSKIY, A. F., Scientific Research Institute for Applied Physical Problems, Belorussian State University

[Abstract] The limiting capabilities of passive mode-locked YAG laser are estimated for existing saturated absorber components. Practical recommendations are given for synthesizing new absorber components that provide the required laser parameters. The criteria developed for selecting absorber components, taken together with the experimental findings, make it possible to optimize passive mode locking in a YAG laser, either in terms of achieving the required set of laser parameters, or in terms of achieving maximum laser capabilities with respect to any one of the parameters. A group of dyes is identifid that provide maximum pulse energy and minimum pulse duration for YAG lasers. The experimental findings are in accord with the theory of passive mode locking of solid state lasers. References 11: 10 Russian, 1 Western.
[284-6900]

UDC 621.373.826

PULSE-PERIODIC YAG:Nd^{3+} ACTIVE MODE-LOCKED LASER WITH INTRACAVITY FREQUENCY DOUBLING

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian Vol 48, No 3, Mar 84 pp 573-576

APANASEVICH, P. A., ZAPOROZHCHENKO, R. G., ZAPOROZHCHENKO, V. A. and KACHINSKIY, A. V., Institute of Physics, Belorussian Academy of Sciences

[Abstract] A YAG:Nd^{3+} active mode-locked laser with intracavity frequency doubling is investigated. The parameters of the laser are given, and the output energy and ultrashort pulse duration are investigated as a function of cavity length for pulse repetition frequencies ranging from 1.5 to 100 Hz. The output energy and single pulse duration are also investigated as a function of the pumping energy. Intracavity second-harmonic generation is studied in an analogous laser. The parameters of pulses at frequencies and 2 are investigated as a function of the difference in the phase creep of the fundamental radiation and the harmonic. Comparison of the experimental findings indicates that a laser with intracavity second harmonic generation is a self-consistent system in which the harmonic pulses can be shortened significantly by selecting such parameters as the phase difference in the crystal, the distance between the crystal and the common mirror of the cavities, the crystal length and the Q of the cavity at the second harmonic. Figures 4, references 1 Russian.
[284-6900]

UDC 535.33:621.378.8

NONLINEAR EFFECTS DURING INTERACTION OF PICOSECOND LASER PULSES WITH GROUP A_2 B_6 WIDE-BAND CONDUCTORS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian Vol 48, No 3, Mar 84 pp 563-568

GRIBKOVSKIY, V. P. and ZYUL'KOV, V. A., Institute of Physics, Belorussian SSR Academy of Sciences

[Abstract] The results of an investigation of second-haromic generation and scattering in group A_2B_6 semiconductors with many-photon excitation are presented. Two-photon absorption, as well as the variation of the index of refraction of the crystals in the transparency region under the influence of laser radiation, are described. A shadow method is employed that is applicable for investigating the mechanism underlying the nonlinearity of the index of refraction and for studying fast recombination processes in semiconductors. Figures 4, references 10: 6 Russian, 4 Western.
[284-6900]

UDC 621.378.325

FORMATION OF SINGLE FEMTOSECOND LIGHT PULSES AT MODULATION FREQUENCY IN PASSIVE MODE-LOCKED LASERS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian Vol 48, No 3, Mar 84 pp 480-491

DIETEL, W., RUDOLPH, W., WILHELMI, B., Friedrich Schiller University, GDR; DIELS, J. C. and FONTAINE, J. J., North Texas State University

[Abstract] New experimental findings are presented concerning the generation of pulses in "colliding" pulse mode locking under various conditions. Frequency modulation and pulse shape are investigated; new theoretical approachess are discussed to make it possible to understand the mechanism underlying the generation of very short pulses and to find optimum conditions for obtaining such pulses. Pulses propagating in one direction in the resonator are examined. It is demonstrated that the cross-effects between pulses that move in opposite direction and meet in a saturated absorber can be accounted for approximately by varying one of the parameters in the solutions for a pulse propagating in one direction. Figures 14, references 19 Western.
[284-6900]

UDC 621.378.325

THEORY OF FREE-ELECTRON LASERS WITH FOCUSING PUMPING FIELD

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 2, Feb 83 (manuscript received 29 Apr 83) pp 299-305

GINSBURG, N. S., Institute of Applied Physics, USSR Academy of Sciences

[Abstract] A nonlinear theory of ubitrons and scatterons with focusing pumping field is investigated for the case of Doppler synchronism. Average electron movement equations are derived. Scattering under normal and anamalous Doppler effect conditions is analyzed. It is noted that since all electron exchange energy with the magnetic field in exactly the same way, there are a number of possibilities for improving the electron efficiency, such as varying the phase velocity of the combination waves along the instrument so that the electrons are always in the retarding phase, and exploiting recuperation of the energy of the electron beam on a collector with lower voltage. References 14: 11 Russian, 3 Western.
[288-6900]

INVESTIGATION OF ELECTROOPTICAL SYSTEMS OF RELATIVISTIC ELECTRON MASERS

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 2, Feb 84
(manuscript received 9 Mar 83) pp 293-298

BOTVINNIK, I. Ye., BRATMAN, V. L., DENISOV, G. G., OFITSEROV, M. M., PETELIN, M. I. and FIKS, A. Sh., Institute of Applied Physics, USSR Academy of Sciences

[Abstract] Resonant driving of particles of a rectilinear beam in a combined spatially periodic and uniform magnetic field is investigated. Methods for creating a spatially periodic magnetic field are analyzed, and findings on the oscillatory rate of electrons in such fields are studied. A diagnosis is made of a beam of electrons following curvilinear trajectories. Figures 5, references 8: 4 Russian, 4 Western.
[288-6900]

UDC 621.378.325

SEGMENTED METAL DISCHARGE TUBES FOR LONGITUDINAL-DISCHARGE ULTRAVIOLET NITROGEN LASERS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 84
(manuscript received 1 Oct 82) pp 178-180

IL'YUSHKO, V. G., KRAVCHENKO, V. F. and MIKHALEVSKIY, V. S., Scientific Research Institute for Physics, State University, Rostov-on-Don

[Abstract] Segmented metal discharge tubes for air- and water-cooled nitrogen lasers (λ =337.1 nm) are described in which the average power and repetition frequency of the lasing pulses are increased significantly. The parameters and operating behavior of the system are described. Figures 3, references 5 Russian.
[223-6900]

UDC 551.508

MULTIFREQUENCY LIDAR BASED ON DYE LASER

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 4, Apr 84
(manuscript received 2 Mar 83) pp 690-695

GANUSHKINA, L. D., GITLIN, Ye. M., IVANOV, A. P., KOVAL'CHUK, A. S., KOROTKIN, I. R., LOYKO, M. M., OSEPENKO, F. P. and CHAYKOVSKIY, A. P.

[Abstract] The transceiving system of a field version of the Gloriya multi-frequency lidar employed for atmospheric sounding at four wavelengths simultaneously is described. The transmitter employed is based on an organic dye laser. The technical specifications of the device are presented. Test

results are discussed, and the aerosol backscattering coefficient obtained is plotted as a function of wavelength. The device continues to be improved, and a special multichannel system for data recording and processing is being developed. Figures 3, references 11 Russian.
[306-6900]

UDC 621.373.8

NARROWBAND TUNABLE DYE LASER WITH AMPLIFIER PUMPED BY POWERFUL NITROGEN LASER

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 4, Apr 84 (manuscript received 20 Mar 83) pp 686-690

DOROFEYEV, S. N., KLIMASHINA, A. G., MNUSKIN, V. Ye., NIKIFOROV, V. G., TRINCHUK, B. F., TOKAREVA, A. N. and FEDOROV, V. A.

[Abstract] A dye laser with a single amplification stage pumped by a Krona-1 nitrogen laser is being investigated. The use of the laser-amplitude system significantly increases the maximum pulse power (up to 120 kW) and laser efficiency (up to 17%), and reduces the angular divergence of the laser radiation by a factor of 1.5 The technical characteristics of a device employing solutions of organic compounds and incorporating an amplifier and a radiation frequency converter are presented. Figures 4, references 11: 4 Russian, 7 Western.
[306-6900]

UDC 621.378.325

BIAXIAL-CRYSTAL LASER WITH WAVEGUIDE RESONATOR

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 4, Apr 84 (manuscript received 6 Jun 83) pp 683-686

BOYKO, B. B., VASHKEVICH, I. M., KASHPAR, Ye. A., PETROVICH, I. P., UVAROVA, N. N. and SHKADAREVICH, A. P.

[Abstract] A laser is developed employing a biaxial crystal waveguide resonator. A prototype employing a potassium-gadolinium tungstate crystal activated with neodyium ions is investigated experimentally. The waveguide resonator laser is found to produce approximately the same power as one employing a Fabry-Perot resonator, although the threshold pumping energy of the waveguide laser is somewhat higher. Anisotropy of the crystal properties is found to have a strong influence on the lasing characteristics of the waveguide laser. The use of biaxial-crystal waveguide lasers is recommended in devices with stringent requirements for divergence of the radiation in one plane. Figures 2, references 6 Russian.
[306-6900]

UDC 543.42

INFLUENCE OF HEAT TREATMENT OF ALUMINUM ALLOY FOIL ON RESULTS OF LASER QUANTOMETRIC ANALYSIS

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII In Russian Vol 40, No 4, Apr 84 (manuscript received 24 Feb 82) pp 665-668

SAFONOVA, Ye. P., YANKOVSKIY, A. A., PETUKH, M. L., LUKICHEVA, A. V. and SMAKOVSKAYA, A. V.

[Abstract] The influence of heat treatment on the results of spectral analysis of aluminum alloy foil is investigated to develop a standard method for analyzing aluminum alloy foils during different stages of manufacture. Experimental data for a number of aluminum-based foil alloys are tabulated. Heat treatment is found to have no effect on results of spectral analysis. References 2 Russian.
[306-6900]

UDC 621.373.826.038.825.4

InGaAsP/InP INJECTION LASERS EMPLOYING THREE-LAYER WAVEGUIDE

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 3, Mar 84 pp 631-633

VASIL'YEV, M. G., DOLGINOV, L. M., DRAKIN, A. Ye., YELISEYEV, P. G., IVANOV, A. V., KONYAYEV, V. P., SVERDLOV, B. N., SKRIPKIN, V. A., SHVEYKIN, V. I., SHEVCHENKO, Ye. G., SHELYAKIN, A. A. and SHEPEKINA, G. V.

[Abstract] Laser heterostructures with three-layer waveguides based on InGaAsP/InP for injection lasers operating in the 1.3 μm band are developed and investigated. The three-layer waveguide heterostructres are prepared by liquid-phase epitaxy on substrates having lower threshold currents than ordinary two-sided heterostructres. The use of step geometry of the profile of the index of refraction increases the optical limiting parameter significantly, which improves optical mode amplification for the same concentration of the injected carriers. Heterostrucrues with three-layer waveguides are recommended for use in ordinary injection lasers, as well as lasers with periodic feedback structures in integrated optical devices in which laser radiation must be passed through a waveguide with low losses. Figures 3, references 7: 1 Russian, 6 Western.
[300-6900]

UDC 535.417.2

EXTERNAL CAVITY WITH NONLINEAR THERMAL FILLING

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 3, Mar 84
(manuscript received 11 May 83) pp 613-616

VLASOV, D. V. and STREL'TSOV, V. N., Institute of General Physics, USSR Academy of Sciences

[Abstract] The excitation of electromagnetic oscillations in an external cavity filled with a substance having highly selective absorption and strong temperature dependence of the index of refraction is investigated. Steady state generation of electromechanic oscillations is provided by an external monochromatic beam. The energy beam density is analyzed as a function of the intensity of the incident beam, revealing a point at which the intensity of the excited oscillations is bounded, leading to an increase in the coefficient of reflection of the exciting beam from the surface of the entrance pupil of the cavity. Such a system can be employed as an efficient amplitude limiter, or as a nonlinear reflecting element. Figures 1, references 5 Russian.
[300-6900]

UDC 621.373.826.038.825.3

SUBPICOSECOND NEODYMIUM PHOSPHATE GLASS LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 3, Mar 84
(manuscript received 31 Oct 83) pp 602-603

BAREYKA, B., PISKARSKAS, A., SINKYAVICHYUS, V. and SIRUTKAYTIS, V., Vilnius State University imeni V. Kapsukas

[Abstract] A passive mode-locked neodymium glass laser employing dye 3321 with relaxation time not exceeding 1 ps is investigated. The experimental setup is described, and the characteristic shape of the autocorrelation function of the pulses is analyzed. The average pulse length was 0.7 ps, with spectral width of 100 cm^{-1}, indicating substantial spectral expansion of the pulses along the pulse train. This is the first instance of solid state laser generation of pulses shorter than 1 ps. Figures 2, references 3: 1 Russian, 2 Western.
[300-6900]

UDC 621.373.826.038.823

ENERGY CHARACTERISTICS OF GDL EMPLOYING TRANSITIONS BETWEEN LEVELS OF SYMMETRIC AND DEFORMATION MODES OF CO_2 MOLECULE

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 3, Mar 84
(manuscript received 27 Apr 83) pp 551-559

ISLAMOV, R. Sh., KONEV, Yu. B., KULIKOV, A. O., ODINTSOV, A. I., FEDOSEYEV, A. I. and SHARKOV, V. F., Institute of High Temperatures, USSR Academy of Sciences

[Abstract] The results of experimental investigations of the energy and spectral characteristics of lasing on transitions between levels of coupled modes in a CO_2 GDL are presented, along with analytical data based on numerical solution of a system of kinetic equations for the level population. It is found that a CO_2 GDL can provide substantial energy (approximately 10 J) for a number of long wave transitions between levels of coupled modes. Efficient lasing is provided by sufficiently strong collision coupling between levels in the resonator zone. Efficient lasing requires collision-free flow in the nozzles, and removal of relaxing impurities from the gas. The energy yield can be increased by cascade lasing. Optimum mixture compositions are determined for vibrational transitions in the 16.4-21.2 μm range. Figures 6, references 17: 16 Russian, 1 Western.
[300-6900]

UDC 621.373.826.038.825.3

NEW CAPABILITIES OF Cr^{3+} AS ACTIVATOR FOR WORKING MEDIA IN SOLID STATE LASERS

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 3, Mar 84
(manuscript received 14 Apr 83) pp 487-492

ZHARIKOV, Ye. V., LAVRISHCHEV, S. V., LAPTEV, V. V., OSTROUMOV, V. G., SAIDOV, Z. S., SMIRNOV, V. A. and SHCHERBAKOV, I. A., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] The spectral-luminescent properties of YScGaG, YGaG, LaLuGaG, GGG and CdScGaG garnets activated by chromium ions and grown by the Czochralski method are investigated. The connection between the lifetime of the excited state of chromium and the ratio of luminescence intensities is analyzed. A method is proposed for determining the energy gap between the ^2E and $^4T_2$ Cr^{3+} levels from the temperature behavior of nonradiative $Cr^{3+} \rightarrow$ acceptor transfer. A relatively small energy gap value is responsible for the highly efficient nonradiative $Cr^{3+} \rightarrow Nd^{3+}$ transition in GGG and GdScGaG crystals. The crystals synthesized provide the potential capability of supporting lasing with continuous frequency tuning over a wide spectral range. The findings make it possible to predict the spectral-luminescent properties of different matrices activated by Cr^{3+} ions and coactivated with another impurity (such as Nd^{3+} ions). Figures 6, references 20: 12 Russian, 8 Western.
[300-6900]

UDC 621.373.826.038.824

GENERATION OF LIGHT IN NEAR INFRARED REGION EMPLOYING SOLUTIONS OF ASYMMETRIC POLYMETHINE DYES

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 3, Mar 84
(manuscript received 24 Feb 83) pp 462-471

BONDAR, M. V., DEREVYANKO, N. A., DYADYUSHA, G. G., ZUBAROVSKIY, V. M., ISHCHENKO, A. A., PRZHONSKAYA, O. V., SLOMINSKIY, Yu. L., SMIRNOVA, A. L., TIKHONOV, Ye. A. and TOLMACHEV, A. I., Institute of Physics, Ukrainian SSR Academy of Sciences, Institute of Organic Chemistry, Ukrainian SSR Academy of Sciences

[Abstract] The photophysical properties of asymmetric polymethine dyes are employed to generate light efficiently with a large red shift. The structural and spectroscopic characteristics of asymmetric polymethine dyes employed are presented, along with their spectral and lasing characteristics. Technical lasing efficiencies of better than 15% are obtained in the 780-850 nm region. Two groups of solvated cations are detected for the series of dyes studied, and the solvate shell of the short-wave solvate is shown to restructure rapidly due to change in the electron structure of the molecules in the excited state. The interaction of the polymethine dye molecules with solutions containing electron-donor groups must be used in explaining spectral and luminescent properties, as well as in realizing active laser media with the required characteristics. Figures 6, references 22: 17 Russian, 5 Western.
[300-6900]

MODE COMPOSITION AND DIVERGENCE OF RADIATION FROM CO_2 GASDYNAMIC LASER WITH WIDE-APERTURE STABLE CAVITY

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 7, 12 Apr 84 (manuscript received 1 Aug 83; revised 23 Jan 83) pp 429-433

GORYACHEV, S. B., KOROLENKO, P. V., NOVOSELOV, A. G., STEPINA, S. A. and SHARKOV, V. F.

[Abstract] The mode composition and spatial characteristics of radiation from a quasicontinuous CO_2 gasdynamic laser operating at $\lambda = 10.6$ μm are investigated experimentally in order to explain anomalies observed in the spatial structure of the beams produced by such a laser employing a wide-aperture cavity. It is found that M-modes are not detrimental to emission divergence, and that they stabilize radiation energy parameters and provide uniform energy output from large volumes of active medium. Figures 2, references 5: 2 Russian, 3 Western.
[303-6900]

PASSIVE Q-SWITCHES FOR LASER CAVITIES BASED ON LiF CRYSTALS WITH COLOR CENTERS

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 7, 12 Apr 84 (manuscript received 25 Jun 81; revised 9 Sep 82) pp 425-429

IVANOV, N. A., PARFIANOVICH, I. A., TITOV, Yu. M., KHULUGUROV, V. M., and CHEPURNOV, V. A., Scientific Research Institute for Applied Physics, Irkutsk State University imeni A. A. Zhdanov

[Abstract] Characteristics of the parameters of Nd^{3+} lasers and ruby lasers with Q-switches based on LiF crystals are presented. New Q-switches based on LiF (F_3^-) are proposed for ruby and alexandrite lasers. Figures 2, references 1 Russian.
[303-6900]

INJECTION LASER WITH RING CAVITY

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 7, 12 Apr 84 (manuscript received 29 Sep 83) pp 397-400

BOGATOV, A. P., YELISEYEV, P. G., OKHOTNIKOV, O. G., RAKHVAL'SKIY, M. P. and KHAYRETDINOV, K. A., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] Interaction of colliding traveling waves in a ring injection laser is investigated. It is found that the interaction mechanism can result in the generation of both standing and traveling waves. The phase, and hence the frequencies, of the waves are "locked", preventing the occurrence of fields at close frequencies. A possible mechanism for such "locking" may be interaction of fields via inversion in a semiconductor [see A. P. Bogatov et al., KVANTOVAYA ELEKTRONIKA, Vol 10, No 9, 1983, p 1851]. The phenomenon described promotes stabilization of the single-frequency lasing mode in a ring injection laser. Figures 3, references 2 Russian.
[303-6900]

UDC 538.561

LINEAR THEORY OF FREE-ELECTRON LASERS WITH CYLINDRICAL INTERACTION SPACE

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 3, Mar 84 (manuscript received 27 Dec 82, final edition received 13 Jul 83) pp 534-540

KARBUSHEV, N. I., RUKHADZE, A. A. and SHATKUS, A. D., Institute of Physics imeni P. N. Lebedev, USSR Academy of Sciences, Moscow

[Abstract] A linear theory is constructed for a free-electron laser with cylindrical interaction space, a microwave device operating with a tubular

relativistic electron beam. The latter and the waveguide through which it propagates are located in the magnetostatic field of an undulator, this field being established by superposition of a pumping field periodically nonuniform along the waveguide axis on a uniform external field. The characteristic equation for a monoenergetic beam is derived on the basis of perturbation theory, assuming an arbitrary radial profile of electron concentration in the waveguide and an infinitesimally thin electron beam tube. This equation describes stimulated radiation of the waveguide mode and includes natural oscillations of electrons. It is identical to the characteristic equation for O-type devices. Particularly important are the Compton mode of operation with a small space charge and the Raman mode of operation with waveguide mode and beam wave interaction, with corresponding constraints on pumping wave amplitude and electron beam current. Participation of a backward companion wave, generated with or without end reflection, is taken into account, conditions for resonance are established, and the effect of possible parasitic waves is included. On the basis of this analysis, relations are derived for gain, efficiency, and starting current in each mode of operation with no electron concentration or velocity modulation at the entrance to the interaction space, assuming also a sufficiently small dispersion of the longitudinal component of electron momentum so that no ubitron operation in the kinetic mode will occur. References 12: 8 Russian, 4 Western.
[243-2415]

UDC 666.189.21.01:66.018

CHEMICAL STABILITY AND VIBRATIONAL SPECTRA OF ULTRAPHOSPHATE FIBERS

Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 10, No 1, Jan-Feb 84 (manuscript received 17 Aug 82) pp 70-74

DUDKO, G. D., ASLANOVA, M. S., SHIROKOVA, A. V., KHODOVA, N. M. and SHEVELEVICH, R. S., All-Union Scientific Research Institute of Glass-Reinforced Plastic and Glass Fiber, Moscow

[Abstract] Rare earth ultraphosphate glass materials are used for the formation of optical fibers. The optical shell of the fiber surface has an organic-silicon content and chemical analysis of water and acid stability and surface hydrolysis makes it possible to estimate phase composition and homogeneity of the fibers. Chemical stability and vibrational spectra of $(R,Nd)P_5O_{14}$ type fibers were studied and components were shown to be close in relative weight. Chemical stability for acid increases from fibers containing Bi to those with Gd, La and Y and this is determined mainly by the relative presence of polyphosphate groups. Infrared spectroscopy showed that there are ultra-, ortho- and polyphosphate groups in the ultraphosphate fiber component. Hydrolysis of the ultraphosphate fiber surface tends to form ortho- and polyphosphates according to infrared absorption spectroscopy. Figures 3, tables 2, references 12: 9 Russian, 3 Western.
[260-12497]

UDC 621.384

LASER SOURCE OF NEUTRAL ATOMS FOR COLLECTIVE-FIELD PARTICLE ACCELERATOR

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 3, Mar 84 (manuscript received 26 Jul 83) pp 527-533

BYKOVSKIY, Yu. A., MIRONOV, V. Ye., SARANTSEV, V. P., SIL'NOV, S. M., SOTNICHENKO, Ye. A., TER-MARTIROSYAN, Z. A. and SHESTAKOV, B. A.

[Abstract] Laser sources for collective-field particle accelerators, of ions of almost all chemical elements, operate in deep vacuum (10^{-8} -10^{-9} torr) and in a strong alternating magnetic field (up to 20 kOe, 50 Hz). Under such conditions a laser source is required to deliver an atom flux of 10^{11} -10^{12} in pulses of 10-100 ms duration from a target to electron rings. Such a laser source has been designed for the collective-field heavy-ion accelerator at the Joint Institute of Nuclear Research. It consists of a laser, focusing lens, and conical target of the material whose atoms are to be extracted. Both lens and target are placed inside the compressor vacuum chamber, the latter having a window for the radiation from the laser placed outside. The target can be located close to the electron rings for maximum utilization of the emitted atom flux. An electron ring becomes loaded with ions as the atom flux crosses it, preferably toward the end of the flux pulse. The equipment for this purpose is, in its basic variant, laid out with the compressor tube mounted on a support inside the vacuum chamber and the laser source in front of the window on the extension of the compressor tube axis. This construction can be modified for large electron rings, with axicon optics that reshape the incoming laser beam into an annular beam for electron rings with radii longer than 8 cm or by moving the laser source from the axial location to a peripheral location relative to the compressor tube for electron rings with radii of 30-35 cm. These three variants of such a laser source were evaluated in an experimental test stand, with a Q-switched YAG:Nd^{3+} laser (wavelength λ = 1.06 μm) emitting radiation pulses of 0.06 J energy and 10 ns duration, and with lead, aluminum, iron, or copper used as target material. With the vacuum in the compressor chamber held at the $3 \cdot 10^{-7}$ torr level, the target capability was determined from the change of atom signal amplitude after repetitive laser (radiation)-target(material) interaction at one spot. Target performance characteristics of the four materials, namely the dependence of atom flux density, mean atom concentration, and partial atom pressure on the incident radiation power density, also the angular distribution of atom flux density and the atom flux as function of the number of radiation-target interaction events have been established on this basis. The results of measurements,

accurate within 20%, indicate that the laser source is most effective with lead targets and least effective with copper targets. It produces atom fluxes of almost any chemical element for optimum loading of electron rings, retaining high stability of parameters and high purity through 10^6 interaction events. It is synchronized with the accelerator control. Stray atoms not reaching the electron rings condense on the compressor chamber walls and on other surfaces so as not to degrade the vacuum. All components are easily interchangeable for adaptation to particular chemical elements or to different electron rings, and the laser source can be easily removed for adjustment or repair. The authors thank G. D. Shirkov for helpful discussions and I. Ts. Ivanov for assistance in testing. Figures 9, references 9 Russian. [243-2415]

ENERGY COMPRESSION OF ELECTRON BEAM IN LINEAR ACCELERATOR TO 300 MeV LEVEL

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 3, Mar 84 (manuscript received 6 Sep 82, final edition received 24 Jun 83) pp 518-526

AFANAS'YEV, N. G., BUKI, A. Yu., VLADIMIROV, Yu. V., DOVBNYA, A. N., IVANOV, G. M., KRAMSKOY, G. D., MAKHNENKO, L. A., POLISHCHUK, V. N., RYABNYKH, S. I., SHEVCHENKO, N. G. and SHENDRIK, V. A.

[Abstract] An energy compressor has been developed at the Kharkov Institute of Engineering Physics (UkSSR Academy of Sciences) that is capable of compressing an electron beam at the exit from a linear accelerator to a narrow energy band at the 300 MeV level, with dispersion not exceeding 0.1% without loss of intensity. Its basic components, like those of existing energy compressors in Mainz (FRG) and in Glasgow (UK), are a magnetic debuncher and a high-frequency waveguide with an accelerating compressor segment. The debuncher is a special-purpose achromatic magnet array, for parallel shifting of a relativistic electron beam and reducing its longitudinal dispersion to 0.55%. This is still inadequate for energy compression and, therefore, the existing magnets used for this purpose had to be optimally redesigned to ensure the necessary optical characteristics. The waveguide, a rectangular one with 90x45 mm cross section and flat flanges, transmits power from the last klystron stage of the linear electron accelerator to the accelerating electron-beam compressor. After compression, the electron beam is focused onto an aluminum-foil target inside the scatterer sphere of an SP-95 magnetic spectrometer. This is done by two revolvable sliced magnets, a pulse collimator between them, and a pair of quadrupole lenses. Other components of the system are a directional coupler followed by a controllable power divider and a phase shifter that divert some of the klystron output power from the last stage of the linear accelerator to the compressor. The equipment, built in the process of design optimization and performance evaluation, was tested on 225 MeV and 120 MeV electron beams. Its main characteristics were measured first without and then with the quadrupole lenses. With the lenses, the compressor was found to narrow the energy spectrum to a relative width of 0.065% and 0.1% at the 225 MeV level and the 120 MeV level, respectively, with corresponding 7.7 and 8.3 compression ratios. Energy stabilization in the compressed electron beam, namely a stability factor as high as 10, is attainable during $\pm$0.5% wide energy

fluctuations in the original electron beam. The revolvable magnets can stabilize the position of a compressed electron beam on the target within 0.2 mm/h. The resolving power of the measuring and recording equipment (0.076% rms) depends on the energy dispersion of electrons at the target, on the dimensions of the electron beam, on the kinematic dispersion of the electron yield of a ^{27}Al nucleus in the target material, on the spectrometer capture angle, on aberrations in the spectrometer, on multiple scattering of electrons by the spectrometer exit foil, and on the dimensions of the scintillation detector behind the spectrometer. The authors thank V. A. Azhippo, V. P. Gonchar, Ye. V. Yeremenko, Ye. A. Zubov, Z. M. Kolot, B. V. Mazan'ko, L. D. Saliyu, A. L. Khomich, and N. A. Shumilova for having solved the practical engineering problems. Figures 5, references 8: 5 Russian, 3 Western.
[243-2415]

UDC 533.92:621.039.62

THERMAL RESPONSE OF FIRST WALL IN FACILITY OF TOKAMAK TYPE TO HEAT LOAD DURING PLASMA STRIPPING

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 3, Mar 84 (manuscript received 25 May 82, final edition received 20 May 83) pp 504-510

DIVAVIN, V. A. and MIKHAYLOV, A. Ye., Scientific Research Institute of Electrophysical Apparatus imeni D. V. Yefremov

[Abstract] For the design of the first wall in a thermonuclear facility of the tokamak type, the problem of wear by evaporation after melting is analyzed theoretically in the worst case of plasma stripping with attendant rise of the heat load to levels as high as $(1\text{-}2)\cdot 10^8$ W/m^2. The basis for the analysis is the "thermal breakdown" model of a semiinfinite body, mathematically described by a nonlinear equation of heat conduction with moving solid-liquid interface and moving evaporation front under appropriate constraints. The corresponding boundary-value problem is solved on the basis of quasi-equilibrium evaporation kinetics and the Knudsen-Langmuir relation, assuming that evaporation occurs at the free surface of the hot liquid phase. Calculations yield the wall surface temperature, the eroded layer thickness, the pressure on the wall, and the fraction of the total heat spent on evaporation as functions of the interaction time over a 20 ms transient period, also the temperature profile across the wall chickness at the end of the heat load pulse. Numerical data obtained for steel, aluminum, and graphite walls agree closely with results of the INTOR project and indicate the necessary wall thickness for a "thin wall with cooling" configuration. Figures 4, table 1, references 22: 20 Russian, 2 Western.
[243-2415]

EFFECT OF STRONG ELECTROMAGNETIC WAVE ON FORBIDDEN BETA-DECAY OF NUCLEI

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 39, No 6, 25 Mar 84 (manuscript received 24 Jan 84) pp 283-285

AKHMEDOV, Ye. Kh., Institute of Nuclear Energy imeni I. V. Kurchatov

[Abstract] Studies are done on the variation of total probabilities of forbidden beta-decays in the field of a strong monochromatic electromagnetic wave and possibilities are discussed for the removal of forbiddenness by absorption by the nucleus from the wave (or emission into the wave) of dipole quanta transferring a certain angular momentum to the nucleus and changing the selection rules. This research is discussed and found insufficient. The power of present-day electromagnetic radiation sources is shown to be below the level required to cause appreciable variation in forbidden beta-decay probabilities. However a strong wave could have an effect on the first forbidden transitions if the maximum laser intensity could be raised by two orders of magnitude which would increase the probability of the process by approximately 10% but considerable technical difficulties would have to be overcome. References 10: 7 Russian, 3 Western.
[247-12497]

UDC 621.039.532.2

EFFECT OF SUCCESSIVE IRRADIATION BY NEUTRONS AND ALPHA-PARTICLES ON RADIATION DAMAGEABILITY OF GRAPHITIC CARBON MATERIALS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 272, No 2, Sep 83 (manuscript received 14 Mar 83) pp 369-372

KHABIBULLAYEV, P. K., ASHRAPOV, T. B., GURIN, V. A., KONOTOP, Yu. F., MAZITOV, B. S., FEDORENKO, A. I., YUNUSOV, Kh. R. and YAMNITSKIY, V. A., Institute of Nuclear Physics, UzSSR Academy of Sciences, Tashkent; Kharkov Physicotechnical Institute, UkSSR Academy of Sciences

[Abstract] In certain thermonuclear reactor projects it is proposed to use graphitic carbon shielding materials that will be subjected to irradiation by fluxes of fast neutrons (E = 14.1 MeV) and alpha-particles (E = 3.52 MeV). The damage resulting from bombardment was studied by irradiating material samples at a temperature of 200°C in a nuclear reactor (neutrons with energy of more than 0.18 MeV) and in a cyclotron (alpha-particles with 32-40 MeV). Graphitic carbon damage was evaluated and depends significantly only on the graphite structure when the weakly-bound layer configuration is modified and changes occur in characteristics and dimensions. Significant changes in electrical characteristics (resistivity) occur but their role was not evaluated for damage effects which are less important than mechanical and thermal events. Computations are given for thermal events in the lattice during the passage of high-energy alpha-particles that lose energy by ionization and collision leading to graphite temperature rise to 1200°C and annealing, thus reducing damage which is shown to be less than forecast. Figures 2, references 7: 5 Russian, 2 Western.
[221-12497]

INITIAL FINDINGS FROM EXPERIMENTS ON ION-CYCLOTRON HEATING OF PLASMA IN TO-2 TOKAMAK

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 39, No 5, 10 Mar 84 (manuscript received 10 Dec 83) pp 196-199

ARTEMENKOV, L. I., AKHMEROV, N. A., BOGDANOV, V. F., VUKOLOV, K. Yu., GOTT, Yu. V., GRODZINSKIY, Ye. V., GUROV, A. A., KOVAN, I. A., MAL'TSEV, S. G., MELIKHOV, P. I., MONAKHOV, I. A., MUKHIN, P. A., PAPKOV, L. N., POPRYADUKHIN, A. P., SOTNIKOV, S. M., YUSOPOV, K. Kh., CHUYANOV, V. A., SHVINDT, N. N. and SHURYGIN, R. V., Institute of Atomic Energy imeni I. V. Kurchatov

[Abstract] Effective heating of hydrogen plasma at the fundamental ion cyclotron frequency is detected on the TO-2 tokamak installation. No significant influence on plasma containment or purity was noted. The Q of the intrinsic modes was less than 50, and was independent of the longitudinal wave number K_z. The strong cyclotron absorption observed is assumed to be associated with an increase in the left-polarized field of the fast magnetosonic wave due to heterogeneity of the magnetic field and the real drift trajectories of the ions in the tokamak. Figure 1, references 4: 1 Russian, 3 Western.
[246-6900]

UDC 538.561

MEASUREMENT OF DISPERSION OF ANGULAR SPREAD OF ELECTRON BEAM IN CYCLIC ACCELERATORS BY SYNCHROTRON RADIATION

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 84 (manuscript received 11 Jan 83) pp 34-37

GUK, I. S. and GLADKIKH, P. I., Kharkov Physical-Technical Institute

[Abstract] A method is described for determining the local dispersion of the vertical angular distribution of the electron beam at one point in the magnetic system of an accelerator or accumulator without disturbing the beam by measuring the angular distributions of the π-component of the synchrotron radiation. Analysis of the vertical electron beam spread during perturbation by vertical betatron oscillations shows the proposed method to be highly accurate throughout the magnetic system of the accelerator. Figures 5, references 9 Russian.
[223-6900]

UDC 621.384.6

HIGH FREQUENCY SECTION OF ELECTRON SYNCHROTRON EMPLOYING TROLL' CYCLOTRON PREACCELERATION

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 84
(manuscript received 22 Nov 82) pp 30-34

PANASYUK, V. S., TERESHKIN, Yu. M. and KHROMCHENKO, V. B.

[Abstract] An electron synchrontron is described in which the cyclotron preaccelerator is a resonance device in which the functions of the electromagnet and resonator are combined in a single unit. The pulsed magnetic field is excited by a single-winding electromagnet whose internal cavity serves simultaneously as a resonator. The electron source is the plasma of the axis of the resonator created with the help of an erosion plasma source. The arrangement of the microwave section of the accelerator is analyzed, and the maximum intensity of the accelerator beam is estimated. Figures 5, references 11: 10 Russian, 1 Western.
[223-6900]

UDC 539.17:621.373.826

INERTIAL THERMONUCLEAR FUSION REACTORS (A REVIEW)

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 3, Mar 84
(manuscript received 1 Nov 82; revised 15 Aug 82) pp 439-457

KALININ, A. V., All-Union Scientific Research Center for the study of surface and vacuum properties

[Abstract] The current status of inertial thermonuclear fusion engineering is reviewed. The state of physical research in the laboratory is discussed. Inertial fusion reactor development and employment for power generation are stressed. Lasers are singled out as the best of all existing initiation systems. The stage of physical laboratory research on laser thermonuclear fusion is now over, and the conceptual deisng of laser function reactors is basically finished. The scientific foundation has now been laid for the design of a demonstration fushion reactor, to be followed by development on an experimental commercial scale. The prerequisites have now been met for developing a long range integrated program for the development of a laser thermonuclear powerplant. Figures 6, references 50: 14 Russian, 36 Western.
[300-6900]

UDC 621.039.58

EXPERIMENTAL INVESTIGATION OF BEHAVIOR OF IODINE RADIONUCLIDES IN LOOP CONTAINING NITROGEN DIOXIDE COOLANT

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA FIZIKA-ENERHETYCHNYKH NAVUK in Russian No 2, Apr-Jun 84 (manuscript received 30 Sep 83) pp 43-46

DRUGACHENOK, M. A., DOLGOV, V. M. and BASHARIN, A. V., Institute of Nuclear Power Engineering, Belorussian SSR Academy of Sciences

[Abstract] The removal of iodine radionuclides from a nitrogen coolant with the help of a rectification column employing ceramic rings is examined experimentally using a GPU-100A loop reactor installation. The effectiveness of radioactive iodine in the decontamination and electrification column is evaluated and is found to have a significant influence on the activity of the coolant. Figures 3.
[298-6900]

UDC 539.143.43+669.018.47

NMR ANALYSIS OF ATOMIC STRUCTURE IN AMORPHOUS IRON-BORON ALLOYS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 1, Mar 84 (manuscript received 3 May 83) pp 79-83

POKATILOV, V. S., Central Scientific Research Institute of Ferrous Metallurgy imeni I. P. Bardin, Moscow

[Abstract] The local atomic structure of iron-boron alloys was studied by an NMR method that yields information about the environment of a given atom rather than average characteristics of a structure. Specimens of alloys with a 13.5-25.0 atom.% B content were produced by rapid quenching of the melt on a rotating copper disk. Specimens with 15 and 22 atom.% B were annealed successively at 280, 360, and 400°C for 60 min at each temperature, then at 510°C for 5, 15, 30, and 60 min respectively. Specimens with 15 atom.% B were finally annealed at 575°C for 30 and 60 min respectively. Both x-ray diffraction analysis and NMR analysis were performed after quenching and after subsequent annealing. The results give the dependence of the hyperfine magnetic field and the evolution of resonance spectra at ^{11}B nuclei on the boron concentration, revealing some asymmetry in quenched Fe-B alloys, on the low-frequency side in Fe- 15 atom.% B and on the high-frequency side in Fe-22 atom.% B. Low-temperature annealing (280-360°C) causes the spectral peak to shift toward higher frequencies, while high-temperature annealing (400°C) gives rise to faint lines corresponding to orthorhombic and tetragonal Fe_3B phases. Low-temperaure annealing results in structural relaxation through redistribution of atoms in the amorphous matrix. In quenched Fe-B alloys the boron atom is surrounded by 9 iron atoms, the short-range order relative to the boron atom being chemically the same in all alloys but being topologically

dependent on the boron content. This model explains the characteristics of various properties such as the concentration dependence of the average magnetic moment of iron atoms. Article was presented by Academician G. V. Kurdyumov on 27 Apr 83. Figures 4, references 11: 4 Russian, 7 Western.
[245-2415]

UDC 533.92.621.039/61

EFFECT OF HYDROGEN ON FORMATION OF ENERGY SPECTRUM OF MULTIPLY CHARGED AND COPPER IONS

Tashkent IZVESTIYA AKADEMII NAUK UZ SSR: SERIYA FIZIKO-MATEMATICHESKIKH NAUK in Russian No 1, Jan-Feb 84 (manuscript received 13 Jan 82) pp 55-57

BEDILOV, M. R. and SABITOV, M. S., Institute of Physics, UzSSR Academy of Sciences

[Abstract] The effect of hydrogen on the energy spectrum of carbon and copper ions of a laser multielement plasma was studied. Copper and polyethelene served as hydrogen-bearing targets. Laser radiation was used for ionization with a laser time-of-flight spectrometer and electrostatic analyzer instrumentation. It was shown experimentally that as hydrogen concentration in the targets increased there was a significant variation in the charge factor and width and characteristics of the copper and carbon and a special feature of the hydrogen spectrum was observed. Independently of the nature of the target, the width of the hydrogen spectrum increases with laser power until the latter reaches an optimum above which the spectrum narrows and disappears. The feature also depends upon hydrogen concentration which agrees with chemical data. Analysis of hydrogen, carbon and copper energy spectra shows differences with the hydrogen spectra narrower in the main and low range (to 350 eV) while the carbon and copper have broad spectra in high energy regions to several keV. Laser power selection can thus separate hydrogen from the multielement plasma and increase the intensity of copper and carbon ions. Figures 4, references 3 Russian.
[24-12497]

UDC 535.417

HOLOGRAPHIC SUBTRACTION OF IMAGES BY FOURIER PLANE RECORDING AND SPATIAL FILTRATION WITH A NARROW BEAM

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 272, No 2, Sep 83 (manuscript received 17 Mar 83) pp 365-369

KLIMENKO, I. S., MALOV, S. N. and RYABUKHO, V. P., Moscow Physicotechnical Institute

[Abstract] Known methods for holographic image subtraction based on phase-shift elements encounter technical problems. Utilization of optical spectra overcomes some difficulties but images have a low brightness because of small

aperture spatial filtration at the interference field minima. The paper describes a simple holographic subtraction method giving a good level of image brightness consisting in obtaining double exposure Fourier holograms recording two separate images with a small shift of the object in the transverse direction between exposures and illumination of the hologram with a small diameter laser beam with subsequent optical Fourier transformation of the reconstructed field. An experiment was done involving images of a piece of chalk taken before and after the microrelief had been mechanically destroyed. Image formation was carried out with an insignificant noise background but the frying noise involved in the use of the small diameter beam was high and limited resolution of dimensions of up to approximately 0.05 mm. Image brightness was approximately two orders better than for a comparable method. Figures 2, references 4 Western.
[221-12497]

UDC 535.41+535.8

ANALYSIS OF MULTI-LAYERED HEAT REFLECTING SCREENS

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 27, No 2, Feb 84 (manuscript received 25 Jan 83) pp 86-91

DMITRIYEVA, O. A., UKHINOV, S. N., KOZIK, V. V. and SEREBRENNIKOV, V. V., Tomsk State University imeni V. V. Kuybyshev

[Abstract] The energy coefficients of reflection and transmission for dielectric-metal-dielectric screens are analyzed recursively. Analysis of the optical characteristics of such systems in which the dielectric layers have different indices of refraction indicates that the higher the index of refraction of the transparent substance, the greater the contrast coefficient of the optical cell of the screen. Systems with an index of refraction of 2.2-2.6 are determined to be best for use as heat-reflecting coatings. Figures 3, references 5 Russian.
[275-6900]

OPTICAL DISCHARGE DURING RESTRICTED LATERAL ESCAPE OF GAS AND REDUCTION OF OPTICAL DETONATION THRESHOLD

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 39, No 5, 10 Mar 84 (manuscript received 12 Jan 83) pp 216-218

BUFETOV, I. A., PROKHOROV, A. M., FEDOROV, V. B. and FOMIN, V. K., Institute of General Physics, USSR Academy of Sciences

[Abstract] Experiments are described in which an optical discharge propagates along the beam of a mullisecond neodymium laser. The propagation of the discharge along a quartz tube is found to vary from subsonic to optical detonation

for the range of radiation intensities of the laser employed. The interval between the plasma front and the shock wave is found to be filled with perturbation waves moving from the plasma front toward the shock wave. Figures 3, references 4 Russian.
[246-6900]

UDC 535.36

ROLE OF MULTIPLE SCATTERING IN TURBIDIMETRIC INVESTIGATIONS OF DISPERSE SYSTEMS

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 2, Feb 84 (manuscript received 18 Oct 82, revised 28 Jun 83) pp 320-323

KHLEBTSOV, N. G.

[Abstract] The role of multiple scattering in turbidmetric experiments conducted on series-produced instruments is studied theoretically. The model employed is the standard model of the theory of radiation transfer in an unbounded plane layer which is struck perpendicular to the boundary by an ideally collimated light flux. It is demonstrated possible to disregard optical density distortion due to multiple scattering; turbidimetric measurements are shown to be insensitive to multiple scattering, thus validating the use of methods for solving the inverse problems developed for the approximation of single scattering to describe real systems. Figures 2, references 25: 19 Russian, 6 Western.
[277-6900]

UDC 537.521.7

INVESTIGATION OF OPTICAL BREAKDOWN IN QUARTZ MICROPOROUS GLASS

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 1, Jan 84 (manuscript received 11 Feb 83; revised 8 Jun 83) pp 183-185

AL'TSHULER, G. B., BAKHANOV, V. A., DUL'NEVA, Ye. G., KEL'BAKH, L. G. and KRYLOV, K. I.

[Abstract] The optical breakdown threshold of quartz microporous glasses with an average pore radius of 30-40 Å is measured by isotherms. The optical breakdown threshold of the glass is found to have pronounced spatial dispersion. Data on the optical breakdown threshold at the first and second harmonics of a neodymium laser are obtained for microporous glasses with and without dye. Figures 2, references 5 Russian.
[197-6900]

UDC 621.373.826

FLUCTUATIONS IN PARAMETERS OF LIGHT BEAM ALONG PATH WITH REFLECTION IN TURBULENT ATMOSPHERE

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84
(manuscript received 7 Apr 83) pp 315-324

KOLIIEVICH, Yu. I. and SOCHILIN, G. B.

[Abstract] The statistical characteristics of light beams reflected from a flat mirror, corner or mirror-lens reflector and a 90-degree prism are compared. The smooth perturbation method is used to compute the correlation function of the fluctuations in the phase, angles of arrival, amplitude levels and dispersion of random shifts in the center of gravity of a gaussian beam reflected in a random heterogeneous medium. Expressions are derived for the correlation of the angles of arrival and dispersion of the random shifts of the center of gravity of the reflected beam, and for the dispersion of the shifts of the center of gravity of the location image of the reflector in the focal plane of a receiving lens combined with the transmitting aperture. The influence of diffraction effects on the dispersion of lateral shifts in the center of gravity of the reflected beam is illustrated. Figures 5, references 16: 15 Russian, 1 Western.
[252-6900]

UDC 621.373.826

POLARIZATION METHODS FOR IMPROVING ENERGY CHARACTERISTICS OF PHASE-CONJUGATE MIRRORS

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84
(manuscript received 7 Apr 83) pp 303-310

YEFIMKOV, V. F., ZUBAREV, I. G., MIKHAYLOV, S. I., SMIRNOV, M. G. and SOBOLEV, V. B., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] A polarization method for decoupling reference waves in a thresholdless reflection and Brillouin amplifier circuit is examined theoretically and experimentally. It is demonstrated that the rise time of both processes is determined by the combined pumping wave intensity. The method can be used in circuits incorporating the Brillouin amplifiers to increase reflection efficiency significantly while retaining phase-conjugate reflection. Figures 6, references 4 Russian.
[252-6900]

UDC 535.345.1:666.22

ACCURACY IN DETERMINING INDEX OF ATTENUATION OF HIGHLY TRANSPARENT GLASSES USING PRISMATIC SPECIMEN

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 1, Jan 84 p 4

GERASIMOV, S. Yu. and KOLYADIN, A. I.

[Abstract] The expected errors in measuring the index of attenuation of glass employing the least-squares method are estimated. A formula is derived for computing the index of attenuation. The prismatic specimen is illuminated in three directions, with each thickness figuring three times, and the total number of measurements is twice the number made in one direction. A numerical estimate of the prism measurement error yields a quantity that is accurate to four decimal places, indicating that measurement of a prismatic specimen by photometer is of interest for investigating the surface properties of glass.
[278-6900]

UDC 551.511.6:621.391.27

MINIMIZATION OF ERROR IN RECORDING ENERGY DISTRIBUTION IN TRANSMISSION OF RADIATION THROUGH ATMOSPHERE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 1, Jan 84 (manuscript received 13 Feb 83) pp 1-3

KORSI, L. V., MORSKOV, V. F., SOKOLOV, V. G. and USTINOV, N. D.

[Abstract] An N-channel matrix measuring and recording system connected optically to a flat diffuse scattering screen is examined. Each channel has a lens that forms an image on the screen, a transparency in the image plane and a photodetector. The optical density of the transparency is determined by the filtering function of the nth channel. A graph is plotted that can be used to estimate the registration error of the distributions under consideration, as well as a broad class of distributions that are encountered in practice. References 3 Russian.
[278-6900]

UDC 535.3

LONGITUDINAL SHIFTING AND SPLITTING OF LIGHT BEAM REFRACTED ON BOUNDARY WITH ISOTROPIC ABSORBING MEDIUM

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 3, Mar 84 (manuscript received 31 May 78; revised 14 Oct 83) pp 493-496

FILIPPOV, V. V.

[Abstract] The plane wave approach is used to analyze longitudinal displacement and splitting of a light beam refracted on the boundary with an absorbing

medium. Two cases are considered: with the electric field of the incident wave oscillating in the plane of incidence, and perpendicular to that plane. Splitting of the light beam is analyzed as a function of the angle of incidence. The plane wave approximation cannot be used when there is a significant amount of splitting because of the sharp reduction in the aperture of the beam and the absorbing medium due to refraction of the boundary. References 8: 4 Russian, 4 Western.
[283-6900]

UDC 535.36

SPACE-ANGLE STRUCTURE OF LIGHT BEAM IN VERTICALLY HETEROGENEOUS SCATTERING MEDIUM

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 3, Mar 84 (manuscript received 1 Dec 82) pp 465-471

VALENTYUK, A. N.

[Abstract] Formulas are derived that describe the space-angle structure of a light beam in a heterogeneous scattering medium in which the scattering parameters fluctuate arbitrarily. The sought solution is obtained as an expansion with respect to a small parameter associated with the scattering index, and includes the region of small and large scattering angles. The method developed can be used for layers of any thickness, since the characteristics of radiation reflected from an optically thick layer in which absorption occurs are determined basically by the parameters of a fairly thin surface layer within which the formulas for the small-angle approximation are satisfied. References 12 Russian.
[283-6900]

UDC 535.375:539.2

INVESTIGATION OF RAMAN SPECTRA OF $Nd_3Ga_5O_{12}$ SINGLE CRYSTALS

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 3, Mar 84 (manuscript received 13 Dec 82) pp 413-418

NOSENKO, A. Ye., BILYY, A. I. and ARTAMONOV, V. V.

[Abstract] The characteristics of the Raman spectra of neodymium-gallium garnet single crystals are investigated with the help of a DFS-24 spectrometer at 80 and 300 K. LG-38 and LG-70 He-Ne and He-Cd lasers were employed in a standard 90-degree experimental geometry. The Raman spectra were excited at 440-455 nm and 640-670 nm. The spectra lines are more clearly defined in the shortwave region than in the longwave region at room temperature, and dropping the temperature to 80 K makes the lines narrower, shifts them to the lower frequency

region and causes a number of new lines to appear in the spectrum. The relative intensity of the high frequency lines (400-700 cm^{-1}) is somewhat higher than at room temperature. The frequencies and types of symmetry of phonon vibrations are established. Figures 2, references 15: 7 Russian, 8 Western.
[283-6900]

UDC 535.37

INVESTIGATION OF PROCESSES UNDERLYING DEACTIVATION OF ELECTRON EXCITATION OF NEODYMIUM IN NON-ALKALINE SILICATE GLASSES

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 4, Apr 84 (manuscript received 10 Jan 83) pp 640-648

MALASHKEVICH, G. Ye.

[Abstract] The luminescence kinetics of non-alkaline silicate glasses is investigated in detail in order to find the values of the microparameters of the extinction and migration interactions of neodymium ions, the minimum possible distance between them and the quantum yields the different metastable state deactivation mechanisms. Decomposition is found to be near exponential for low neodymium concentrations. As the neodymium concentration increases, the temporal behavior of the luminescence intensity becomes highly nonexponential. Mathematical expressions are derived for estimating the values of teh microparameters that determine the rate of nonradiative deactivation of the metastable state of neodymium ions. Resonant cross-relaxation interactions of neodymium ions on deactivation of the metastable state are found to be characteristics for neodymium glasses. The quantum luminescence yield of these glasses at low activator concentrations is found to be fairly high. The relationship between donor-donor and donor-acceptor microparameters and the ratio of the vitrifying components discovered makes it possible to improve the luminescent characteristics of such glasses by optimizing their composition. Figures 4, references 9: 8 Russian, 1 Western.
[306-6900]

UDC 535.36

EXPERIMENTAL INVESTIGATION OF SCATTERING OF LIGHT BY LARGE "SOFT" OPTICALLY ISOTROPIC ASPHERICAL PARTICLES

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 4, Apr 84 (manuscript received 26 Nov 82) pp 630-634

DUBOVA, G. S., KOROLEVICH, A. N. and KHAYRULLINA, A. Ya.

[Abstract] The spectral behavior of the indices of refraction and attenutation of disks and spheres of equivalent volume with optical constants n and κ ranging from 1.05 to 1.06 and 10^{-3} to 10^{-5}, respectively, are investigated

experimentally in the 0.4-1.0 μm range. The scattering indices within the region of angles $1° \leqslant \gamma \leqslant 20°$ and $90° \leqslant \gamma \leqslant 140°$ are investigated in detail. The indices of attenuation and absorption are measured spectrally by an SFD-2 spectrophotometer. The particle absorption cross section is found to depend little upon shape. Scattering indices are tabulated for various optical constants and particle microstructural parameters. Figures 3, references 17: 8 Russian, 9 Western.
[306-6900]

UDC 551.593.52

LABORATORY INVESTIGATION OF COEFFICIENTS OF ABSORPTION OF AIR AT λ=10.6 μm

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 4, Apr 84 (manuscript received 7 Dec 82) pp 599-604

TOPORKOV, Yu. G.

[Abstract] The coefficients of absorption of air are determined at λ=10.6 μm in order to establish the contribution of different gaseous components to the overall coefficients of attenuation (absorption) and to assess aerosol influence. The experimental setup is described in detail. The recorded coefficient of attenuation of air is analyzed as a function of absolute humidity for different laser powers. The coefficients of absorption due to aerosol are found to be significant against the background of the gaseous component. Figures 3, references 16: 10 Russian, 6 Western.
[306-6900]

UDC 535.33

OPTICAL CONSTANTS OF AQUEOUS SOLUTIONS OF PHOSPHORIC ACIDS IN 0.4-14 μm SPECTRAL REGION

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 4, Apr 84 (manuscript received 11 Jan 83) pp 579-583

AL'PEROVICH, L. I., KOMAROVA, A. I., OZERENSKIY, A. P., SIDOROV, A. I. and SHPITKO, L. V.

[Abstract] The optical constants of aqueous solutions of phosphoric acids are investigated by measuring the transmission spectra of the investigated liquids to gain information regarding optical properties. The transmission spectra of thin plane-parallel layers of solutions 4-8 μm thick contained between flat calcium fluoride plates are measured. The spectrum of the index of refraction is calculated by the Kramers-Kronig method. The spectra of the index of absorption and refraction of orthophosphoric acid are analyzed. The method can be recommended for a solution of any acid in any concentration within the range of concentrations studied. Figures 3, references 8: 6 Russian, 2 Western.
[306-6900]

UDC 621.378.325:535.21

SPECTROSCOPIC INVESTIGATIONS OF POLYMER PHOTOTROPIC MEDIA EMPLOYED FOR CONTROLLING LASER RADIATION

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 4, Apr 84 (manuscript received 29 Dec 82) pp 555-560

YEREMEYEVA, Ye. P., OVCHINNIKOV, V. M., ARKHIPOV, V. P., IVANOVA, T. F., PITERKIN, B. D. and SMIRNOVA, Z. A.

[Abstract] Spectrophotometry and radio spectroscopy are used to investigate changes in the physicochemical characteristics of polymers and polymethane-based polymer phototropic media with absorption band in the 1.0-1.3 μm region caused by radiation: coherent-resonant (λ=0.16 μm) and nonresonant (λ=0.694 μm) and incoherent ionizing--ultraviolet and gamma radiation of ^{60}Co. Neodymium glass and ruby lasers in the single pulse mode served as coherent radiation sources. The resistance of polymer films and polymer phototropic media to laser radiation is investigated, and the change in the spectral characteristics of polymer phototropic media caused by ionizing ultraviolet and gamma ^{60}Co radiation are studied. Figures 3, references 9 Russian.
[306-6900]

UDC 760.484.08

SPATIAL COHERENCE FUNCTION, MODE COMPOSITION AND MODE FIELD STRUCTURE OF LASER RADIATION

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 4, Apr 84 (manuscript received 31 Jan 83) pp 546-550

ZAMOTRINSKIY, V. A., KOVALENKO, Ye. S., KOLCHINA, G. A. and SHANGINA, L. I.

[Abstract] The possibility of determining resonator modes on the basis of expanding the spatial coherence function of the radiation with respect to coherent components is discussed. The case of a steady state process in which there are not mode locking effects is investigated. Mode recovery is investigated for a lossless plane resonator, a lossless spherical resonator and a lossy plane resonator. It is demonstrated that the spatial coherence function can be used to find the mode composition of radiation as well as the field structure of the individual modes. The differences between the recovered and initial field in lossy resonators are found to be regular and fundamental. Figures 2, references 7: 5 Russian, 2 Western.
[306-6900]

UDC 535.37

ATOMIC FLUORESCENCE METHOD FOR DETERMINING ALKALI METAL VAPOR CONCENTRATION WITH USE OF LASER SOURCE

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 4, Apr 84 (manuscript received 27 Dec 82) pp 533-536

BUDKIN, L. A., OKHOTNIKOV, O. G., PAK, G. T., PIKHTELEV, A. I. and PUZANOV, S. L.

[Abstract] An atomic fluorescence method for determining the concentration of alkali metal vapor by using a laser source is examined using cesium atoms as an example. A GaAlAs semiconductor laser source was employed. The fluorescence signal was recorded in the direction perpendicular to the laser beam. A system of balance equations corresponding to a three-level approximation of the quantum structure of alkali metal atoms is derived to determine the quantitative relation between the fluorescence signal and atom concentration. The experimental results agree well with the theoretical calculations for cesium vapor. Figures 3, references 12: 11 Russian, 1 Western.
[306-6900]

UDC 535.317.1

OPTIMAL LINEAR FILTERING OF IMAGES

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 1, Jan 84 (manuscript received 24 May 82) pp 175-178

STOLYAROV, Yu. V.

[Abstract] A linear filtering algorithm is developed that is optimal under the following assumptions: a) the grain noise of the material on which the image is recorded is additive; b) the noise spectrum is constant, or the grain noise is white noise and statistically independent of the signal; c) there is no internal noise in the optical recording system, the processing and the filter, and there is no image digitization of quantization noise; d) the minimum mean square deviation criterion in Wiener's algorithm is correct. Tests performed on a coherent optical system are described. Figure 1, references 9: 6 Russian, 3 Western.
[310-6900]

UDC 535.2:546.212

INTERNAL FIELD OF WATER DROPLET AT 3.39-10.6 μm LASER WAVELENGTHS

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 1, Jan 84
(manuscript received 30 Dec 81) pp 128-131

LOSKUTOV, V. S. and STRELKOV, G. M.

[Abstract] The internal field in water droplets at laser wavelengths of 3.39-10.6 μm is investigated for diffraction parameter values of up to approximately 900 in order to identify the conditions under which internal field maxima are formed and disappear as droplets consolidate. The internal field in absorbing water droplets is found to be highly irregular; explosive decomposition of absorbing droplets, analogous to that observed in experiments with weakly absorbing droplets, is possible over a wide range of radii. The pulse energy required for explosive droplet decomposition is estimated. Figures 3, references 11 Russian.
[310-6900]

UDC 621.373.826

TYPES OF OSCILLATIONS IN RESONATORS WITH MIRRORS THAT PRODUCE PARTIAL PHASE CONJUGATION

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 3, Mar 84
(manuscript received 24 May 83) pp 591-597

BEL'DYUGIN, I. M. and ZOLOTAREV, M. V.

[Abstract] The matrix approach is employed to investigate the influence of frequency shift, amplitude and phase distortions on the behavior of vibration modes in a resonator incorporating phase-conjugate mirrors. It is found that different factors that determine phase-conjugate reflection have different influence on formation of modes of oscillations in a resonator with phase-conjugate mirrors. It is found that when the phase distortions are not excessive, diffraction on the aperture of the mirror retards the modes of the resonator in the stable region, and the role of phase distortions consists only of deforming these modes. The findings indicate that the transverse dimensions of modes of oscillations can be controlled by introducing different types of distortions in the mirror. It is shown that special measures can be taken to make resonators incorporating mirrors equivalent to an unstable resonator, with all of the advantages of the latter, while providing output radiation insensitive to optical distortions in the active medium. Figures 2, references 6: 3 Russian, 3 Western.
[300-6900]

UDC 621.373.826.038.823

NEW EMISSION LINES IN VISIBLE AND INFRARED SPECTRAL REGIONS IN A THULIUM-VAPOR LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 3, Mar 84
(manuscript received 30 May 83) pp 624-626

GERASIMOV, V. A., PROKOL'YEV, V. Ye., SOKOVIKOV, V. G. and SOLDATOV, A. N.,
Institute of Atmospheric Optics, Siberian Department, USSR Academy of Sciences

[Abstract] Rare-earth elements with comparatively low evaporation points are investigated in order to obtain emission in the visible portion of the spectrum by exciting their vapors in a pulsed gas discharge. The experimental setup is described. Emission lines are obtained in the orange (λ=589.948 nm) and near IR (λ=1101.1 nm) regions of the spectrum. The thulium atom, which has the lowest metastable and upper levels, is found to be the best rare earth element for providing emission in the visible region of the spectrum. Figure 1, references 8: 5 Russian, 3 Western.
[300-6900]

EFFECTIVE CORRELATION PROCESSING METHOD FOR SPECTRAL DATA IN HIGH SENSITIVITY LASER GAS ANALYSIS

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI Vol 10, No 8, 26 Apr 84
(manuscript received 10 Nov 83) pp 502-507

KOSICHKIN, Yu. V., KUZNETSOV, A. I. and PEROV, A. N.

[Abstract] A method is described for processing spectral data based on using information about the structure of the spectrum of the gas being analyzed, as well as information about the nature of the background signal of the diode laser gas analyzer, in correlation analysis. Estimates and computer modeling using real spectra indicate that the method provides sensitivity gains of two or more orders of magnitude over the present method, especially in analyzing gases with complex spectra. Figures 2, references 11: 5 Russian, 6 Western.
[302-6900]

INCREASING LIGHT TRANSMISSION IN DIRECTION OF DEPOSITION OF SUSPENSION OF TURBID MEDIA DURING PRECIPITATION

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI Vol 10, No 7, 12 Apr 84
(manuscript received 2 Jan 84) pp 394-397

ASKAR'YAN, G. A., Institute of General Physics, USSR Academy of Sciences

[Abstract] Transmission of light completely through a precipitating substance, through the entire turbid medium in the direction of precipitation

including the layers of increasingly dense precipitate, is investigated. An experimental setup is described that incorporates an LG-75 helium-neon laser radiating through a vessel containing the precipitating liquid. The turbid medium consisted of corundum powder in water. The proposed approach can be used to irradiate biological media in view of the possible intensification and acceleration of precipitation by artificially enhanced gravity (centrifugal and inertial means). Figures 3, references 3 Russian. [303-6900]

UDC [illegible].37:548.0

PHASE RELAXATION, SPECTRAL DIFFUSION AND CAPTURE OF 29 cm^{-1} RESONANT PHONONS IN OPTICALLY EXCITED $Al_2O_3:Cr^{3+}$ RUBY

Leningrad FIZIKA TVERDOGO TELA in Russian Vol 26, No 4, Apt 84 (manuscript received 12 May 83; revised 10 Nov 83) pp 1016-1026

MALYSHEV, V. A. and SHEKHTMAN, V. L., Physical-Technical Institute imeni A. Ioffe, USSR Academy of Sciences

[Abstract] An "adiabatic" approach within the theory of multiple multichannel resonant scattering is examined. The findings are employed to assess the influence of two nonelastic processes on the capture of 29 cm^{-1} phonons: 1) inelastic incoherent scattering caused by transverse relaxation of an electron state, and 2) resonant Raman scattering caused by splitting of the $\bar{E}$ level by local magnetic fields. The experimental findings are compared with theoretical results. Figures 3, references 34: 16 Russian, 18 Western. [327-6900]

UDC 621.378.9:535.82

FIBER CABLE IN OPTICAL SYSTEM WITH BRIGHTNESS AMPLIFIER

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 274, No 6, Feb 84 (manuscript received 10 Aug 83) pp 1373-1376

ALEYNIKOV, V. S., corresponding member, USSR Academy of Sciences, BUNKIN, F. V., DIANOV, Ye. M., ZEMSKOV, K. I., KAZARYAN, M. A., PETRASH, G. G., academician PROKHOROV, A. M. and SAVRANSKIY, V. V., Institute of Physics imeni P. N. Lebedev, USSR Academy of Sciences, Moscow

[Abstract] Two basically different principles of image transmission over optical fiber cables as light guides in optical systems with brightness amplifiers are feasible, namely transmission of the original image from object to amplifier or transmission of the amplified image. The first principle can be implemented with the brightness distribution at the cable entrance either shaped directly without the aid of optics or preshaped by a lens, with respectively

a solid object-cable contact or a longer segment of stiff fiber cable required. A comparative evaluation of these three schemes reveals that gain is highest in the third and lowest in the first, resolution is equally high and field of vision is equally large in both, resolution being lowest and field of vision being smallest in the second scheme. Figures 3, tables 1, references 3 Russian.
[228-2415]

UDC 535.37+541.14

CRYOLUMINESCENCE OF LIQUIDS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 1, Mar 84 (manuscript received 19 May 83) pp 83-86

TROKHAN, A. M., LAPSHIN, A. I. and GUDZENKO, O. I., All-Union Scientific Research Institute of Physicotechnical and Radiotechnical Measurements, Mendeleyevo, Moscow Oblast

[Abstract] Spontaneous luminescence during fast freezing and cooling, originally discovered in solutions of lanthanide salts, was also recorded in an experiment with over 100 translucent tinted fluids including pure and sea water, organic and inorganic solvents, solutions, mixtures, and melts. Tests were performed in a Dewar flask with transparent walls containing 4.5 cm^3 specimens and cooled at various rates with liquid nitrogen or its cold vapor. Freezing was recorded by a change in electrical conductivity, glow flashes were recorded with a photomultiplier, and the temperature was measured with a Chromel-Alumel thermocouple. The results reveal that excitation of cryoluminescence requires a sufficiently high cooling rate, 0.1-30°C/s depending on the substance. The glow process is a sequence of separate pulses with shorter than 0.1 s extinction time and repetition rate of 10^{-1}-10^2 Hz depending on the substance. According to the character of glow kinetics, described by curves of glow intensity as a function of time, all substances fall into three type: 1) with distinct separate glow peaks (water, aqueous solutions, acetone); 2) with densely packed glow peaks (alcohols, organic acids, ethers); 3) with glow peaks superposed on a flat glow level representing the "tails" of individual peaks (methoxy compounds). The time distribution of cryoluminescence depends also on the initial temperature and aggregation of a substance, the glow intensity being higher for a substance that is liquid before cooling than for a substance that is solid before cooling, and the glow intensity decreasing rapidly as the initial temperature drops below the melting point. The results of this study indicate that electrical phenomena such as piezoelectric and pyroelectric effects as well as charge segregation on fresh surfaces and movement of charged dislocations in the solid phase, all associated with mechanical stresses in rapidly forming crystals, play a significant role in excitation of cryoluminescence analogous to acoustic emission during cracking and to radio emission. Microinclusions with metastable structure and unstable ions or radicals also contribute to cryoluminescence. Article was presented by Academician S. A. Khristianovich on 13 Apr 83. Figures 3, references 4: 3 Russian, 1 Western.
[245-2415]

FORMATION OF WAVEGUIDE CHANNELS IN OPTICAL FIBERS BASED ON CHALCOGENIDE VITREOUS SEMICONDUCTORS

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 6, 26 Mar 84 (manuscript received 29 Oct 84 [sic]) pp 377-381

ANDRIYESH, A. M., VYKOVSKIY, Yu. A., BORODAKIY, Yu. V., MIRONOS, A. V., SMIRNOV, V. L. and PONOMAR", V. V., Moscow Engineering-Physical Institute

[Abstract] The possibility of using optical methods to produce a complex profile of the index of refraction in optical fibers based on calcogenide glass is studied. Optical fibers of As_2S_3 up to 800 mm in diameter produced by vacuum drawing were employed. The index of refraction of the fiber core at 0.7 μm is close to 2.48, and can vary depending upon the stoichometric composition of the fiber material and the method by which it is prepared. The profile of the index of refraction occurring when a chalcogenide glass optical fiber is exposed to an argon laser beam is examined. The proposed method can be used to create analogs of integrated optical elements such as couplers, multiplexers, modulators, etc. The method can be used to record holograms and diffraction gratings on chalcogenide glass in order to produce efficient devices for data processing, matching, demultiplexing, diffraction-type deflectors, etc. Figures 2, references 8: 6 Russian, 2 Western. [267-6900]

NONLINEAR SYMMETRIZATION OF PICOSECOND PULSES IN OPTICAL FIBERS

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 6, 26 Mar 84 (manuscript received 2 Jan 84) pp 338-341

DEMCHUK, M. I., MIKHAYLOV, V. P., PROKHOROV, A. M., SISAKYAN, I. N., SHVARTSBURG, A. B. and YUMASHEV, K. V., Institute of General Physics, USSR Academy of Sciences, Moscow

[Abstract] The results of initial experiments on controlled nonlinear adjustment of the envelope of a picosecond laser pulse in an optical light guide are presented. The ultrashort pulse source was a passive mode-locked YAG laser. The change in form and duration of asymmetric ultrashort pulses 25 ± 2 and 31 ± 2 ps long at the fiber input were investigated. Pulse symmetrization is shown to be associated with two types of spectral deformation: spectral

broadening during nonstationary absorption in the thin-film gate, and self-modulation of the pulse in the fiber. Decreasing the attenuation decrement of the absorber increases the phase velocity of the signal. The role of initial modulation is shown to be more significant in the evolution of short pulses than of long ones. Part of the trailing edge of long pulses remains unmodulated, which exacerbates the tendency toward pulse spreading. References 5 Russian.
[267-6900]

LINEAR MOVEMENT MEASURING SYSTEMS WITH ACOUSTOOPTICAL MODULATORS

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 6, 26 Mar 84 (manuscript received 9 Jan 84) pp 330-334

LEMANOV, V. V., MALAMED, Ye. R., SKVORTSOV, Yu. S., YUSHIN, N. K. and YAKHKIND, E. Z.

[Abstract] Two systems for measuring linear movements are described, one providing increments of 0.01-0.02 μm and a range of up to 100 mm, which is used in manufacturing VLSI chips, and the other of which provides increments of 0.1-0.2 μm and has a range of up to 1200 mm. Both systems employ solid state STF-2 (STF-376) glass modulators and are fully automated. The sensitivity of these devices is doubled by using a prism to obtain a signal corresponding to a single-period change in phase by shifting the raster by half a period. Figures 2, references 2 Russian.
[267-6900]

UDC 53:51

TRANSFER FUNCTION OF MULTILAYERED MAGNETOOPTICAL SPACE-TIME MODULATOR

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 1, Jan 84 (manuscript received 6 Apr 83) pp 115-119

PETROV, M. P. and BELOTITSKIY, V. I., Physical-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] The transfer function and pulse response of a multilayered magnetooptical space-time optical modulator operating in the linear mode are found. The transfer function is found to be axisymmetric if the first layer is magnetized along the Oz axis. When the spatial frequencies are high, the absolute value of the gain drops off as $\exp(b\gamma)$. A fundamental feature of magnetooptical space-time optical modulators is the suppression of zero-order spatial frequencies. If magnetic recording tape is used as the first layer, it is currently possible to input data to an optical circuit at up to $8 \cdot 10^5$ bits/cm^2. The low coercivity of epitaxial layers of ferrite garnets makes it possible to obtain dynamic ranges exceeding 40 dB. Figures 3, references 10 Russian.
[197-6900]

HARMONIC DISTORTIONS IN OPTICAL FIBER COUPLERS DURING DIGITAL INFORMATION TRANSMISSION

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 1, Jan 84
(manuscript received 27 Dec 82; revised 31 May 83) pp 107-109

PIKARNIKOV, V. P., SKVOROV, L. I. and SMIRNOV, V. M.

[Abstract] Distortion of the signal as it passes through fiber junctions, due to the gap between the ends of the fibers, is studied. Generation of parasitic even harmonics in those junctions is studied. The distortion values created by even harmonics in fiber optic connnectors are found for parasitic harmonics 2ω and 4ω for gaps between fiber ends ranging from 0.1 to 100 um. The distortion values created by higher harmonics are derived as well. Figure 1, reference 1 Russian.
[197-6900]

QUANTUM RESTRICTION OF ELECTRON-OPTICAL METHOD OF INVESTIGATING FAST PROCESSES

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 1, Jan 84
(manuscript received 28 Mar 83) pp 51-55

BULYGIN, V. S.

[Abstract] The temporal resolution of the electron-optical method is examined from a quantum viewpoint. The relationship between the durations of the wave packets before the after amplification by an electron-optical transducer is derived. The shortest pulse length that the transducer can register, which is determined by quantum mechanical spreading, is found. When the accelerating field intensity is high, the quantum mechanical limit will restrict the temporal resolution of the transducer to that level already determined by other factors, such as the sweep rate or kinetics of photoemission from the photocathode of the transducer. Figures 2, references 8: 7 Russian, 1 Western.
[197-6900]

UDC 53:51

SURFACE ELECTRODYNAMICS DURING PERMITTIVITY PERTURBATION IN MICROSCOPICALLY NARROW REGION. REFLECTION OF LIGHT IN MULTILAYERED MODEL

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 1, Jan 84
(manuscript received 8 Feb 83) pp 19-31

KOSOBUKIN, V. A. and SAMSONOV, A. M., Physical-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] The reflection of an electromagnetic wave from a multilayer system is studied during nonlocal perturbation of permittivity in a microscopically

thin "layer" on one of the interface boundaries. The zero-order approximation in constructing the perturbation theory in this case is the electrodynamics of solid media with abrupt boundaries. The perturbation method employed makes it possible to assess the contribution of approximation of different order and can be used to describe many optical phenomena. The first-order corrections are computed for the electromagnetic field and the coefficients of reflection, since these contain the basic perturbation information. A three-layer plane-parallel dielectric medium is examined in the zero-order approximation. Disturbed total internal reflection is discussed with allowance for molecules adsorbed on metal. A model is presented and discussed. Figure 1, references 20: 6 Russian, 14 Western.
[197-6900]

UDC 621.373.826

PARAMETERS OF ACOUSTOOPTICAL SIGNAL AS FUNCTION OF RADIUS OF EXCITED ZONE

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84
(manuscript received 15 Jul 83) pp 414-416

DZHIDZHOYEV, M. S., POPOV, V. K., PLATONENKO, V. T. and CHUGUNOV, A. V.,
Moscow State University imeni M. V. Lomonosov

[Abstract] The behavior of the amplitude of the signal of an acoustooptical detector is investigated experimentally as a function of the radius of the light beam; the amplitude and form of the detector signal are analyzed theoretically as a function of the radius of the excited region. It is found that the form of the acoustic signal depends strongly on the radius of the beam. Figures 2, references 4 Russian.
[252-6900]

UDC 621.373.826.038.823

ACOUSTOOPTICAL DETECTION EMPLOYING TWO-FREQUENCY CO_2 WAVEGUIDE LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84
(manuscript received 27 May 83) pp 407-409

GANDURIN, A. L., KONOVAPOV, I. P., KORNILOV, S. T., LARIN, S. G. and
CHIRIKOV, S. N., Moscow Engineering-Physics Institute

[Abstract] The findings from experiments employing a two-frequency waveguide CO_2 laser as an acoustooptical detection source are described. Two-frequency lasing is achieved by applying swuare-wave voltage to a piezoelement to which the laser mirror is fastened. The background signal associated with absorption of laser radiation in the detector windows is eliminated by this arrangement, and sensitivity is improved. Figures 3, references 5: 3 Russian, 2 Western.
[252-6900]

UDC 621.373.826

OPTICAL RECORDING OF INFORMATION ON LAYERS OF TEMPERATURE SENSITIVE COPPER SALTS

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 2 (140), Feb 84
(manuscript received 18 Nov 82) pp 385-386

BAYEV, S. G., BESSMEL'TSEV, V. P., LOMOVSKIY, O. I. and LUSHNIKOV, A. Ya., Institute of Automation and Electrometry, Siberian Department, USSR Academy of Sciences

[Abstract] The results of an investigation of thermal optical recording on layers of copper hypophosphite are described. Energy characteristics are analyzed, and an example is given of an image produced on textolite. Copper hypophosphite-based compounds all found to be a promising recording material for thermal optical recording, and can be used to record information output from computers, in printing and in printed circuit production. Figures 2, references 7 Russian.
[252-6900]

UDC 536.24

THERMAL AND MATHEMATICAL MODELING OF OPTOELECTRONIC DEVICES

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 46, No 4, Apr 84
(manuscript received 21 Dec 82) pp 659-666

DUL'NEV, G. N. and USHAKOVSKAYA, Ye. D., Leningrad Institute of Precision Mechanics and Optics

[Abstract] Optoelectronic devices are described and classified hierarchically, and a thermal modeling method is proposed that enables analysis of the temperature fields of individual components of optoelectronic devices, considering external effects and fundamental thermal interrelations. Thermal and mathematical models are validated for individual modeling stages, and a method is proposed for implementing the models. Figures 2, references 23: 22 Russian, 1 Western.
[290-6900]

UDC 537.86

FORMATION OF RADIO IMAGES BY SCANNING AROUND CIRCLE

Minsk DOKLADY AKADEMII BELORUSSKOY SSR in Russian Vol 28, No 2, Feb 84 (manuscript received 15 Apr 83) pp 123-126

BELYACHITS, A. Ch., KUKHARCHIK, P. D. and SEMENCHIK, V. G., Scientific Research Institute of Applied Problems in Physics imeni A. N. Sevchenko

[Abstract] A long-wave holographic system with circular aperture is considered for formation of radio images. Its indeterminacy function is derived from the geometrical relations, taking into account scattering. A circular aperture of radius R is compared with a square one of area 2Rx2R, their performance being evaluated in terms of resolution with half-width of the principal peak of the indeterminacy function at base (zero) level as criterion. Complete reconstruction of an image $I = B(x_S, y_S)$ upon interchange of coordinates is found to be feasible, owing to the filter property of the Bessel function J_0. Calculations reveal that a circular aperture is more efficient than a square one, inasmuch as it requires π times fewer samples along one coordinate. Article was presented by Academician (BSSR Academy of Sciences) M. A. Yel'yashevich. Figures 2, references 3 Russian.
[224-2415]

UDC 535.527

NUMERICAL INVESTIGATION OF CHARACTERISTICS OF CURRENT FLOW FOR DIFFERENT METHODS OF OBTAINING DISCHARGE IN HIGH SPEED LASERS. MECHANISM UNDERLYING CURRENT FLOW IN POSITIVE GLOW DISCHARGE COLUMN

Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 21, No 5, Sep-Oct 83 (manuscript received 20 Dec 82) pp 865-870

BREYEV, V. V., DVURECHENSKIY, S. V. and PASHKIN, S. V.

[Abstract] Positive glow discharge columns are examined for different methods at obtaining discharge from the viewpoint of the model of a nonstationary plasma; the roles of detachment and the heterogeneity factor are investigated in various experiments to study elementary discharge processes. Experimental data are interpreted from this viewpoint as well. The study includes steady-state self-maintained and semi-self-maintained alternating current, as well as discharge in a decaying plasma. The mechanism underlying the current flow cannot be described unless allowance is made for heterogeneities in the plasma in the direction in which the current is moving. Figures 5, references 14: 12 Russian, 2 Western.
[268-6900]

UDC 537.527

CALCULATION OF OPTICAL AND ELECTROPHYSICAL CHARACTERISTICS OF ARC DISCHARGES IN ALKALI METAL VAPORS

Moscow TOPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 21, No 4, Sep-Oct 83 (manuscript received 1 Jun 82) pp 858-864

GRADOV, V. M., SHCHERBAKOV, A. A. and YAKOVLEV, A. V.

[Abstract] A mathematical model of a discharge in alkali metal vapors is developed, and material functions are derived that can be used to obtain the real relationships between radiation characteristics of sources and the basic parameters of these sources. The basic electrophysical and radiation characteristics of arc discharges in alkali metal vapors, as well as the optical and transport properties of the plasma, are investigated. Figures 4, references 33: 23 Russian, 10 Western.
[268-6900]

COLLISION-FREE SHOCK WAVE IN SUPERSONIC PLASMA FLOW WITH $\beta \simeq 1$

Moscow PIS'MA V ZHURNAL ESKPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 39, No 5, 10 Mar 84 (manuscript received 29 Dec 83) pp 205-207

ARKHIPOV, N. I., ZHITLUKHIN, A. M., SAFRONOV, V. M., SIDNEV, V. V. and SKVORTSOV, Yu. V.

[Abstract] The dynamics of a supersonic collision-free plasma flow with $\beta \simeq 1$ in a lengthwise increasing magnetic field is investigated. The experimental setup is described and the distribtuion of the vacuum magnetic field in the liner is analyzed. The formation of a collision-free shock wave in a supersonic plasma flow compressed in a conical diffuser limits the degree of compression that can be obtained in this way, but allows the mechanism to be used for efficient plasma heating. Figures 2, references 8: 4 Russian, 4 Western.
[246-6900]

UDC 533.95

BREMSSTRAHLUNG FROM LONGITUDINAL PLASMA WAVES PRODUCED BY SUBTHERMAL ELECTRONS IN PLASMA

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR: FIZIKA in Russian Vol 19, No 1, Jan-Feb 84 (manuscript received 4 Apr 83) pp 15-19

AKOPYAN, A. V., Institute of Radio Physics and Electronics, Armenian SSR Academy of Sciences

[Abstract] The bremsstrahlung produced by a longitudinal plasma wave (l-wave) created during collisions of nonequilibrium subthermal electrons and the ions of an isotropic, homogeneous fully ionized plasma is examined. Expressions are derived for the probability and intensity of radiation for pairwise electron-ion collision; the problem of wave instability during collective retardation of groups of electrons on ions is discussed. Collisions of subthermal electrons with one another and with thermal plasma electrons are shown to contribute little to the creation and amplification of l-waves. Some numerical estimates are given. References 7: 6 Russian, 1 Western.
[274-6900]

UDC 533.9.082.5

DIAGNOSIS OF STATIONARY OPTICAL DISCHARGE PLASMA IN LASER PLASMOTRON MODE

Moscow FIZIKA PLAZMY in Russian Vol 9, No 6, Nov-Dec 83 (manuscript received 28 Jan 82) pp 1269-1277

TERASIMENKO, M. V., KOZLOV, G. I. and KUZNETSOV, V. A., Institute of Mechanics, USSR Academy of Sciences

[Abstract] Results of spectral and holographic investigations of the parameters of the plasma produced by a laser plasmotron are presented. The mechanism by which the discharge temperature is established is determined, and the change in the structure of the light detonation wave as the velocity of the stabilizing gas stream increases is studied. It is demonstrated possible to increase significantly the parameters of an optical discharge plasma, thus opening up a way of obtaining a stationary nonideal plasma. Figures 7, references 10 Russian.
[213-6900]

UDC 533.951

INJECTION OF COMPENSATED RELATIVISTIC ELECTRON BEAMS NEAR PLASMA HALF-SPACE

Moscow FIZIKA PLAZMY in Russian Vol 9, No 6, Nov-Dec 83 (manuscript received 5 Nov 81; revised 2 Aug 82) pp 1254-1260

GRIGOR'YEV, V. P., DIDENKO, A. N. and ISAYEV, G. P., Scientific Research Institute for Nuclear Physics, Tomsk Polytechnical Institute

[Abstract] The interaction of compensated relativistic high-current electron beams with a plasma half-space is examined theoretically. The plasma is assumed to be cold, and there are assumed to be no external fields. The density of the electron beam is smaller than that of the plasma electrons. An expression is derived for the permittivity tensor to describe the linear electromagnetic properties of the plasma. The influence of the intrinsic magnetic field of the beam on the plasma parameters is disregarded. The effect of refraction from a plasma layer can be used to transport pulsed electron beams with current of up to I_A if the pulse length is less than or approximately equal to γ_1^{-1}. References 8 Russian.
[213-6900]

UDC 533.9.07

SPATIAL DISTRIBUTION OF STREAMS OF CHARGE TRANSFER ATOMS AND ION TEMPERATURE AND THEIR CHARACTERISTICS OF OHMIC HEATING MODE OF PLASMA ON L-2 STELLATOR

Moscow FIZIKA PLAZMY in Russian Vol 9, No 6, Nov-Dec 83 (manuscript received 23 Jun 82) pp 1209-1218

GREBENSHCHIKOV, S. Ye., KOVRIZHNYKH, L. M., SBITNIKOVA, I. S., KHUDOLEYEV, A. V. and SHPIGEL', I. S., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] The spatial distributions of the ion temperature and exiting streams of charge transfer atoms in an L-2 stellator are obtained. The profile of the ion temperature is found to drop off toward the periphery of the plasma in the region opposite the direction of drift. The ion temperature profile in the direction of drift is distorted because of drifting of particles trapped in the corrugation of the helical field of the stellator. A model of the movement of trapped ions in the L-2 stellator is proposed. Figures 10, references 8: 5 Russian, 3 Western.
[213-6900]

UDC 533.951

PLASMA PROBING BY LINEARLY POLARIZED RADIATION NEAR SECOND CYCLOTRON HARMONIC IN L-2 STELLARATOR

Moscow FIZIKA PLAZMY in Russian Vol 9, No 6, Nov-Dec 83 (manuscript received 26 Feb 82) pp 1194-1200

SMOLYAKOVA, O. B., SUVOROV, Ye. V., FRAYMAN, A. A. and KHOL'NOV, Yu. V., Institute of Applied Physics, USSR Academy of Sciences

[Abstract] A detailed experimental investigation is made of the transmission of linearly polarized radiation through a plasma. Two coherent normal waves are excited: the phase offset between these waves can lead to a significant change in the intensity of either linearly polarized component, even when there is no wave absorption in the plasma. An experimental setup is described that enables estimation of the optical thickness of the plasma for an extraordinary wave. The manner in which the parameters of the plasma vary can be judged by studying the temporal behavior of the intensities of a fixed-frequency signal with two orthogonal polarizations. A modification is proposed in which rapid scanning of the frequency of the probing radiation can be used to make measurements in a stationary plasma. Figures 5, references 7: 5 Russian, 2 Western.
[213-6900]

UDC 533.932

ANAMOLOUS ION-ACOUSTIC ABSORPTION OF ELECTROMAGNETIC RADIATION BY TURBULENT MAGNETOACTIVE PLASMA

Moscow FIZIKA PLAZMY in Russian Vol 9, No 6, Nov-Dec 83 (manuscript received 5 Jul 82) pp 1184-1193

BYCHENKOV, V. Yu., KOVALEV, V. F. and SILIN, V. P., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] Theoretical findings are presented that characterize a possible transmission channel for r-f energy into plasma perturbations, leading to anamolous absorption of radiation and realizable in a plasma with developed ion-acoustic turbulence. The occurrence of turbulence that can develop due to ion-sonic instability can lead to effective transformation of electromagnetic radiation, to potential oscillations of the plasma on strong ion-sonic pulsations, and therefore to additional efficient r-f heating of the plasma. The findings are verified by a numerical example. References 13: 8 Russian, 5 Western.
[213-6900]

UDC 533.951

PARTICLE ACCELERATION IN MAGNETIZED ELECTRON-POSITRON PLASMA

Moscow FIZIKA PLAZMY in Russian Vol 9, No 6, Nov-Dec 83 (manuscript received 20 Apr 82) pp 1177-1183

MACHABELI, G. Z., Abastuman Astrophysical Observatory, Georgian SSR Academy of Sciences

[Abstract] A possible mechanism underlying the acceleration of particles in the tail of the distribution function caused by nonlinear and quasilinear processes is examined. A linear theory of waves propagating in an electron-positron plasma is examined. Quasilinear interaction of cyclotron waves with plasma particles is studied. The matrix element of induced wave scattering on plasma particles is calculated, and the role of that process in the extension of the tail of the particle distribution function is analyzed. References 10: 8 Russian, 2 Western.
[213-6900]

UDC 533.951.8

MHD-INSTABILITY OF ROTATING PLASMA

Moscow FIZIKA PLAZMY in Russian Vol 9, Nov-Dec 83 (manuscript received 10 Jun 82) pp 1157-1161

BREYZMAN, B. N. and TSEL'NIK, F. A., Institute of Nuclear Physics, Siberian Department, USSR Academy of Sciences

[Abstract] Stability conditions are derived for a plasma layer located between two coaxial conducting cylinders for low-frequency trough-type potential perturbations with $k_z=0$. A large number of stable distributions of ω_i and n are found, indicating that MHD stability of rotating plasma can be achieved under actual experimental conditions. References 7: 5 Russian, 2 Western. [213-6900]

UDC 533.933

ABSOLUTE INSTABILITY ACCOMPANYING STIMULATED BRILLOUIN SCATTERING IN LASER PLASMA

Moscow FIZIKA PLAZMY in Russian Vol 9, No 6, Nov-Dec 83 (manuscript received 29 Apr 82; revised 11 Nov 82) pp 1148-1156

ANDREYEV, A. A. and SHATSEV, A. N., State Optics Institute imeni S. I. Vavilov

[Abstract] The increments and frequencies of absolutely increasing modes are obtained as a function of the basic characteristics of the plasma, laser radiation and recording conditions of the scattered radiation; the saturation of absolute instability of stimulated Brillouin scattering in laser plasma is calculated. A laser plasma with $T_e \sim 1$ keV, $L_N \sim 0.01$ cm, $L_U > L_N$ and $\lambda_D = 1$ u is investigated. It is shown that absolute instability can be excited in the plasma for the laser radiation parameters used in the experiment. Figures 3, references 18: 10 Russian, 8 Western.
[213-6900]

UDC 532.5.013.4:538.4

BIFURCATION OF EQUILIBRIUM FIGURES IN MAGNETOHYDRODYNAMICS AND INFLUENCE OF AUTOMATIC CONTROL SYSTEM

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian No 5, Sep-Oct 83 (manuscript received 29 Apr 82) pp 18-24

KOLODYAZHNYY, A. A. and LADIKOV, Yu. P.

[Abstract] Equilibrium bifurcations of a liquid metal (plasma) held in suspension by a magnetic field are employed to study bifurcation flow modes of

two layers of liquid in the long-wave approximation. Bifurcations of the solution of the problem of a plane layer of liquid metal contained by a magnetic field are investigated, as are bifurcations of a cylindrical conductor in a magnetic field. Bifurcation equilibrium forms are found to be symmetric with respect to the axis of the conductor. The influence of an automatic control system on bifurcation equilibrium forms is investigated; it is found that a single winding can affect the nature of bifurcation equilibrium forms. Figures 3, references 6 Russian.
[258-6900]

UDC 537.533.7

DYNAMICS OF SEPARATION OF ANODE FOIL IRRADIATED BY STRONG RELATIVISTIC ELECTRON BEAMS

Leningrad ZHURNAL TEKHNICESKOY FIZIKI in Russian Vol 54, No 1, Jan 84 (manuscript received 20 May 82; revised 14 Dec 82) pp 155-161

DEMIDOV, B. A., IVKIN, M. V., KIRILENKO, V. G., OBUKHOV, V. V., PETROV, V. A. and TOMASHCHUK, Yu. F.

[Abstract] The pressure in and near the immediate energy release zone is determined by measuring the rate of separation of anode foils with various thicknesses under the influence of strong relativistic electron beams. The pressure measurements at the focal point of the relativistic electron beam agrees well with the comparison model cited. A new phenomenon of repeated interaction with the anode plasma of pressure pulses is found which is apparently associated with magnetohydrodynamic effects. Figures 7, references 16: 12 Russian, 4 Western.
[197-6900]

EXPERIMENTAL INVESTIGATION OF MECHANISMS UNDERLYING SEPARATION OF ELEMENTS IN ROTATING PLASMA

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 2, Feb 84 (manuscript received 23 Jun 83) pp 254-261

KOROBTSEV, S. V., KOSINOVA, T. A., RAKHIMBABAYEV, Ya. R. and RUSANOV, V. D.

[Abstract] The physical processes occurring in a plasma centrifuge that can lead to radial separation of elements are analyzed experimentally. It is demonstrated that centrifugal force is the basic separation mechanism. Effective separation of elements by masses with high coefficients of separation is demonstrated possible. Separation in a plasma centrifuge can be optimized by selecting the appropriate working parameters. Figures 6, references 12: 10 Russian, 2 Western.
[288-6900]

SCATTERING OF ELECTROMAGNETIC WAVES BY PLASMA HALF-SPACE AFTER INITIATION OF MOTION

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 2, Feb 84
(manuscript received 22 Mar 83; revised 6 Jun 83) pp 216-226

NERUKH, A. G., Kharkov Institute of Radioelectronics

[Abstract] The problem of the scattering of an electromagnetic wave normally incident on the plane boundary of a plasma half-space initiating uniform motion perpendicular to its boundary at some arbitrary moment is solved. The problem of diffraction is reduced to scatter form, and the equation for the field that enters the plasma medium is derived by the integral equation method. The problem is solved for the case in which the plasma begins to move at time zero; subsequent solutions in space-time representation are then obtained on the basis of general concepts regarding the polarization of a medium with space-time dispersions. The difference between the solution of the diffraction problem for the transmitted field when movement starts at time zero and at infinity is examined. The use of the integral equation method enables identification of all characteristics of electromagnetic wave diffraction on a plasma half-space that begins to move uniformly at a finite moment in time, as well as solution of such a diffraction problem. Figures 6, references 11: 10 Russian, 1 Western.
[288-6900]

UDC 537.534.2

INCREASING BRIGHTNESS OF BEAM FROM ARC PROTON SOURCE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 84
(manuscript received 16 Sep 82) pp 44-49

BATKIN, V. I., GETMANOV, V. N. and SAVCHENKO, O. Ya., Institute of Chemical Kinetics and Combustion, Siberian Department, USSR Academy of Sciences

[Abstract] The design of a pulsed arc hydrogen plasma source with grid formation of a proton beam is optimized to increase beam brightness. This is achieved by employing a source in which the anode fitting and grid assembly can move independently. The relationship between the brightness of the beam generated and the state of the gas in the discharge chamber and in the region in which the plasma escapes from the outlet of the arc channel ahead of the plasma grid is studied experimentally. It is demonstrated that there is an optimum jet path length that depends on the flux density. A source that produces a beam of neutral hydrogen atoms obtained by overcharging the proton beam is also discussed. Figures 5, references 11: 9 Russian, 2 Western.
[223-6900]

UDC 533.9.08+539.2

PLASMA SPECTROSCOPY WITH QUASIMONOCHROMATIC ELECTRICAL FIELDS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 3, Mar 84
(manuscript received 17 Jun 83) pp 607-611

OKS, Ye. A.

[Abstract] A number of new capabilities of diagnosing quasimonochromatic electrical fields in plasma are proposed on the basis of identified plasma spectroscopy principles. The interaction of three subsystems is analyzed: the radiator, quasimonochromatic electric fields and chaotically moving charged plasma particles. Spectral line broadening by interaction of the radiator with one of the other subsystems has a strong influence on its interaction with the other subsystems. Some effects of plasma charged-particle modification of impact broadening parameters are presented. Figure 1, references 13: 9 Russian, 4 Western.
[270-6900]

UDC 533.9

KINETICS OF MOLECULE OSCILLATIONS IN NONEQUILIBRIUM PLASMA

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 3, Mar 84
(manuscript received 20 Jul 83) pp 603-606

MACHERET, S. O., RUSANOV, V. D. and FRIDMAN, A. A., Institute of Atomic Energy imeni I. P. Kurchatov; Institute of Petrochemical Synthesis imeni A. V. Topchiyev, USSR Academy of Sciences, Moscow

[Abstract] A theory is proposed enabling determination of vibrational distributions of molecules in a plasma with allowance for electron impact and relaxation processes. It is demonstrated that the influence of multi-quantum eV processes leads to new qualitative effects, such as the formation of plateaus on the distribution function, even when the role of resonant VV-exchange is weak. References 5 Russian.
[270-6900]

UDC 539.18

THEORY OF INTERACTION OF HIGH-CURRENT RELATIVISTIC ELECTRON BEAM AND MAGNETIZED PLASMA WAVEGUIDE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 1, Mar 84
(manuscript received 1 Jun 83) pp 56-59

BLIOKH, Yu. P., KARAS', V. I., LYUBARSKIY, M. G., ONISHCHENKO, I. N. and academician (UkSSR Academy of Sciences) FAYNBERG, Ya. B., Kharkov Institute of Engineering Physics, UkSSR Academy of Sciences

[Abstract] Instability of a high-current relativistic electron beam propagating through a plasma in a waveguide in a strong external magnetic field is analyzed

on the basis of Cherenkov interaction and anomalous Doppler interaction. The corresponding dispersion equation reveals a maximum instability increment within the range of Cherenkov resonance for "weak" electron beams and within the range of Doppler resonance for "strong" electron beams. This change in hydrodynamic instability depending on the electron beam density is attributed to a change in the phase velocity of the fast Doppler wave, which in a strong electron beam exceeds the maximum phase velocity of the slow plasma wave. The dispersion equation was solved numerically for values of parameter $\mu^3 = \gamma n_b/n_p$ (γ - relativistic factor, n_b - beam density, n_p - plasma density) from 1 to 10 and for Cherenkov resonance frequency $\omega = \frac{1}{3}\omega_p$. The results reveal quasi-longitudinal polarization of the instability wave, while quasi-transverse polarization occurs and an instability threshold appears in the absence of Cherenkov resonance. The threshold density of the electron beam above which it becomes unstable is independent of the oscillation energy during the initial linear stage and subsequently becomes a function of the wave amplitude, only a small increase of the threshold being enough to stabilize the electron beam. A nonlinear theory is constructed on the basis of Maxwell equations and nonlinear equations of motion and continuity for beam electrons and plasma electrons. The existence of steady waves coresponding to 2 - periodic solutions with respect to the longitudinal variable only is established, also predominance of the anomalous Doppler effect over the Cherenkov effect in the case of high-current electron beams. The results indicate ways to optimize the design and the performance of relativisitic microwave devcies. Figure 1, references 5: 3 Russian, 2 Western.
[245-2415]

UDC 533.95

BREMSSTRAHLUNG RADIATION FROM LONGITUDINAL PLASMA WAVES CAUSED BY SUBTHERMAL ELECTRONS IN PLASMA

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR: FIZIKA in Russian Vol 19, No 1, Jan-Feb 84 (manuscript received 4 Apr 83) pp 15-19)

AKOPYAN, A. V., Institute of Radiophysics and Electronics, ArSSR Academy of Sciences

[Abstract] Longitudinal plasma wave bremsstrahlung is produced in the collision of nonequilibrium subthermal electrons with the ions of an isotropic homogeneous completely ionized plasma. The velocity of the test electrons is less than the average thermal velocity of the plasma electons (maxwellian velocity), but still high enough to allow the applicability of a quasiclassical approximation. The density of the test electrons is assumed to be much less than the plasma thermal electron density. Analytical expressions are derived for the bremsstrahlung probability and spectral intensity. The collision of a group of test electrons and plasma ions involving both spontaneous and stimulated bremsstrahlung is analyzed and the expressions describing the braking instability of the plasma waves derived in this instance are illustrated as applied to the case of slow electrons distributed in the form of a directional flow so that the distribution function falls off markedly when the velocity is in the vicinity of the average

velocity of the flow and the electrons are uniformly spatially distributed in the flow. Collisions of subthermal electrons with each other and with thermal plasma electrons are also possible in a plasma, however analysis shows that the contributions of these processes to the production and amplification of longitudinal waves are small. A numerical estimate shows that when the plasma temperature is about 10^3 eV, the plasma density is about 10^{15} cm^{-3}, the flow density is about 10^{10} cm^{-3} and the average flow velocity is on the order of 10^8 cm/s, plasma waves with wavelengths of approximately 10^{-1} cm and longer will appear during a characteristic time of about 10^{-2} s. References 7 Russian. [238-8225]

UDC 539.2

MECHANISM OF BRITTLE HEAT FRACTURE OF INHOMOGENEOUS SOLIDS BY HIGH TEMPERATURE GAS JETS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 272, No 2, Sep 83 (manuscript received 8 Dec 82) pp 358-361

DIMITIYEV, A. P., GONCHAROV, S. A. and GERMANOVICH, L. N., Moscow Mining Institute

[Abstract] The mechanism of brittle fracture inhomogeneous solids by high temperature gas jets occurring in heat treatment of materials, plasma spraying, heat fracture of rocks and other physico-technical processes is studied. Since fractured surface areas are significantly smaller than the dimensions of the body, an infinite half-space is conceived as thermally fracturing with convective heat exchange with a gas jet on the boundary. A model of a two-component random-nonhomogeneous granular medium is used. Thermal stresses concentrate in a narrow surface layer whe e particles are thin and flat so that rupture occurs by stability loss. When the disrupted layer is sufficiently thick and temperature and heat exchange values not too high, thermal fracture occurs by peeling but when the disrupted layer thickness is small and temperatures and heat exchange values high stability loss does not occur and the surface cracks. In brittle peeling, temperature goes from microfracture to fracture temperature which is less than the melting point and this pattern explains fracture mechanisms and rock behavior in thermal drilling. Figure 1, references 10 Russian.
[221-12497]

UDC 539.4.096:536.48

QUANTUM CHARACTERISTICS OF KINETIC FRACTURING OF SOLIDS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 274, No 6, Feb 84
(manuscript received 26 Apr 83) pp 1362-1366

SALGANIK, R. L., SLUTSKER, A. I. and AYDAROV, Kh., Physico-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad; Institution of Problems of Mechanics, USSR Academy of Sciences, Moscow

[Abstract] Research on solid body kinetic fracturing shows the role of thermal fluctuation fracturing of interatomic bonds. Fracturing constitutes one of the forms of chemical solid-phase reactions and has a characteristic Arrhenius reatio of reaction rate to temperature. Because of the exponential increase in the rate of interatomic bond breakdown with increasing tension, sample durability coincides logrаithmically with the average expectation time for interatomic bond fracture. The structure of the test material affects only the steepness of the fracture barrier as the tension increases and a drop in temperature should affect quantum characteristics of bond breakage. Quantum effects are taken into account in the study of collective movements of atoms under strong tension and have been studied for simple atom chains and on the basis of single-particle tunneling. The resulting model is applied to larger structures and quantum features are experimentally studied in the fracturing of boron fibers and the polymers kevlar-49 and polycaprimade at temperatures from 4.2 K to 400-800 K. The results show kinetic fracturing as a process in which, at temperatures significantly lower than the characteristic temperature for the material, a significant role is played by quantum fluctuations, while thermal fluctuation effects increase with the temperature and predominate above the characteristic temperature. Figures 4, table 1, references 12: 9 Russian, 3 Western.
[237-12497]

UDC 620.1_539.3

EFFECTIVE MODULI OF ELASTICITY OF UNIDIRECTIONAL FIBROUS COMPOSITE

Moscow DOKLADY AKADMII NAUK SSSR in Russian Vol 275, No 3, Mar 84
(manuscript received 13 Jun 83) pp 586-589

MOL'KOV, V. A. and POBEDRYA, B. Ye., Moscow State University imeni M. V. Lomonosov

[Abstract] A sequence of two recursive problems is used to describe the theory of elasticity for composites with regular structure for the averaging method. Each problem in the first sequence is a uniform elasticity boundary value problem for which the effective modulii are found by solving the heterogeneous elasticity problems of the second sequence. The stress in each component of the composite is then found by solving the problem of effective modulus theory d(0). Exact analytical expressions for the independent components of the effective tensor of the elastic moduli of the composite are presented. Figure 1, references 8 Russian.
[270-6900]

UDC 539.3:621.375.826

THERMOELASTIC STABILITY OF COOLED LASER MIRRORS

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 45, No 4, Oct 84
(manuscript received 14 Jun 82) pp 640-646

KHARITONOV, V. V. and KOSHELEV, S. B.

[Abstract] The influence of the manner in which flat mirrors are secured, and of the cooling rate, on thermal stresses and deformation and on acceptable optical loading of the mirrors is studied. The maximum thermal power absorbed by a free-standing mirror is found to be independent of the thickness and dimensions of the mirror, and is determined only by thermophysical properties and acceptable deformation. Rigidly clamped mirrors are assumed to be highly unstable. Figures 2, references 6: 4 Russian, 2 Western.
[312-6900]

UDC 533+539

DYNAMICS OF WAVE PROCESSES IN SPHERICAL EXPLOSION CHAMBER

Minsk DOKLADY AKADEMII NAUK BELORUSSKOY SSR in Russian Vol 28, No 2, Feb 84
(manuscript received 12 Apr 83) pp 143-145

MARCHENKO, A. I. and ROMANOV, G. S., Scientific Research Institute of Application Problems in Physics imeni A. N. Sevchenko

[Abstract] Wave processes in a spherical explosion chamber are analyzed on the basis of a mechanical and gas dynamic model. Wave motion and elastic stresses produced inside such a chamber by a shock load on its wall are calculated, disregarding the practically significant but theoretically irrelevant strength characteristics and dissipation effects. The corresponding equations for a mechanically continuous multiregional medium with spherical symmetry are formulated in Lagrange coordinates. These equations have been solved by numerical methods, with the thermodynamic state described by Tillotson equations and the stress-strain relations corrected in accordance with the Mises condition for an elastoplastic material. The results reveal oscillations of thermodynamic variables at the chamber wall, depending on the wave dynamics inside the chamber. Multiple reflections of shock wave pulses stabilize the frequency of these oscillations at approximately 4 kHz and their amplitude, after initial attenuation. The results also reveal an elastic stress field in the wall chamber that excites elastic waves propagating through the chamber. The model is found to yield more valid and rigorous data than models based on constant pressure or its simple analytical approximations. Article was presented by Academician (BSSR Academy of Sciences) R. I. Soloukhin. Figures 2, references 8 Russian.
[224-2415]

UDC 530.12:531.51

GRAVITATIONAL VACUUM

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 274, No 6, Feb 84
(manuscript received 16 Aug 83) pp 1352-1357

GRIGORYAN, L. Sh. and SAAKYAN, G. S., corresponding member ArSSR Academy of Sciences; Yerevan State University

[Abstract] It has been through that gravitation changes only the space-time metric but it can be supposed that through homogeneity and isotropy disturbances the physical state of the vacuum can change leading to a special gravitational vacuum. Polarization effects have been supposed to generate a gravitational vacuum but it might also be due to elastic tensions resulting from space distortions and the Casimir effect and quark processes may be examples. The paper supposes the existence of a special gravitational vacuum and utilizes a phenomenological method differing from the traditional einsteinian formalizations. Vacuum, metric and matter form a complex determined by field equations and at great distances from gravitational masses vacuum effects are small but could be large in powerful fields. Singularities and black holes justify the approach as well as the Ambartsmyan theory concerning the existence of supermassive and superdense prestellar bodies that then disintegrate. A theory for these superdense bodies is developed involving gravitatitional field equations that describe the vacuum by an energy-momentum tensor and define the field and mass distribution. Computations based on the theory for gravitational radii with incompressible liquid models adequately reflecting real conditions indicate that a gravitational vacuum could have considerable effects on superdense stars and could have radical effects for very large masses. Figures 2, references 1 Russian.
[237-12497]

UDC 539.12:530.145

LINEAR CONFORMAL GRAVITATION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 274, No 6, Feb 84
(manuscript received 25 Jul 83) pp 1345-1348

PAL'CHIK, M. Ya. and FRADKIN, Ye. S., corresponding member, USSR Academy of Sciences; Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences, Moscow

[Abstract] Conformal gravitation described by a lagrangian involving a Weyl tensor forms a field theory of interest for the quantum gravitation problem. Einsteinian gravity acting over large distances arises as a result of dynamic symmetry breaking while small distances are fully described by conformal gravitation. The latter is analyzed in the paper on the supposition that solutions have complete conformal symmetry but this is justified only for small distances and determined types of material fields. Two cases are shown for which solutions are possible: a) special fields whose interactions result in the absence of conformal anomalies (for example, in relation to conformal supergravitation) and b) for link constants coinciding with Gell-Mann function zeroes. Consideration is limited to linear gravitation or abelian gage theory. The solution of the quantum equation is invariant relative to the conformal transformations but contradictions arise due to difficulties in all gage theories. Recent advances in quantum electrodynamics are used and the authors develop improved transformation laws and a non-trivial metric field generator and show that the tensor equations express the equivalence of the conformal group representation. Representation spaces and subspaces, and equivalence and invariance characteristics are examined. References 11: 2 Russian, 9 Western.
[237-12497]

UDC 681.518.3:65.015:681.3

ENTROPY MODEL OF OPTIMIZATION OF COMPLEX INFORMATION-MEASUREMENT SYSTEMS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 4, Apr 84
(manuscript received 12 Oct 83) pp 821-823

PETROV, V. V., corresponding member, USSR Academy of Sciences, AGEYEV, V. M., PAVLOVA, N. V., Moscow Aviation Institute imeni Sergo Ordzhonikidze

[Abstract] A model is derived on the basis of an entropy approach to optimizing the structure of complex information measurement systems that describes the most probably distribution of the information sources by concentrators; the physical meanings of all of the coefficients of the models derived are explained. References 15: 6 Russian, 9 Western.
[285-6900]

UDC 621.384.6.01

SIMULATION OF PROCESS OF ION ACCUMULATION IN ELECTRON BEAMS

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 2, Feb 84 (manuscript received 26 Jul 82; revised 12 Jun 83) pp 270-278

PEREL'SHTEYN, E. A., SHEVTSOV, V. F., SHIRKOV, G. D., and SHCHINOV, B. G.

[Abstract] The distribution function of ions during sequential accumulation of ion charges is studied. The influence of nonlinearity of the electron fields and intrinsic fields of the ions on the movement and distribution function of ions is studied with respect to the cross section of a circular beam. The findings are valid for sufficiently thin electron rings, for which field corrections associated with curvature can be disregarded. The influence of ion charge on the distribution function of ions and electrons, and the electrical field potential, is investigated by the large-particle method. The accumulation and transition of ions from charge to charge is modeled by examining several charges simultaneously, and the dynamics of the variation in the mean square dimensions and velocities is modeled as a function of the ion charge. Figures 7, references 11: 8 Russian, 3 Western.
[288-6900]

UDC 533.92

DYNAMICS OF STRONG-CURRENT RELATIVISTIC ELECTRON BEAM IN EXTERNAL MAGNETIC FIELD

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR: SERIYA A, FIZIKO-MATEMATICHESKIYE I TEKHNICHESKIYE NAUKI in Russian No 4, Apr 84 (manuscript received 22 Feb 83) pp 61-63

ZOLOTARYUK, A. V., KUZ'MENKO, N. V. and KHODATAYEV, K. V., Institute of Theoretical Physics, Ukrainian Academy of Sciences

[Abstract] The dynamics of a relativistic electron beam injected into a cylindrical vacuum drift tube with constant cross section in an external axial magnetic field is analyzed. The nonstationary transport model of the beam is described by a system of Maxwell-Vlasov equations. The Maxwell equations are solved by a finite-difference algorithm, and the Vlasov equation by the macroparticle method. The space-time structure of the transport process is described as a function of the external magnetic field, and the relationship between the critical current and the system parameters is specified. Figures 2, references 6: 4 Russian, 2 Western.
[301-6900]

UDC 621.039.58

MATHEMATICAL MODELING OF VARIABLE AND TRANSIENT MODES IN TURBINES EMPLOYING DISSOCIATING COOLANT

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA FIZIKA-ENERYETYCHNYKH NAVUK in Russian No 2, Apr-Jun 84 (manuscript received 20 Jul 83) pp 97-101

SHAROVAROV, G. A. and STANKEVICH, L. A., Institute of Nuclear Power Engineering, Belorussian SSR Academy of Sciences

[Abstract] Mathematical modeling of variable and transient processes is examined on the basis of a closed system of differential equations describing the physical processes occurring in turbine channels during chemical reactions in the coolant. Unidimensional differential equations in dimensionless form based on the generalized transfer equation are employed in the modeling. Analysis of the data shows that the transient processes occurring in the cases considered are practically inertialess. Figures 2, references 5 Russian. [298-6900]

UDC 551.574.1+551.574.12+551.576

ANALYTICAL SOLUTIONS OF EQUATION OF KINETICS FOR CONDENSATION SIZE SPECTRUM OF CLOUD DROPS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 274, No 6, Feb 84 (manuscript received 24 Mar 83) pp 1368-1372

SMIRNOV, V. I. and NADEYKINA, L. A., Central Aerological Observatory, Dolgorudnyy, Moscow Oblast

[Abstract] Condensation of water vapor in the atmosphere as a result of cooling of the ascending air is analyzed, including the effects of turbulence and hygroscopicity of cloud seeds as well as the effects of time diversity between drops and of air entrainment from below. The size distribution of water drops is characterized by the spectrum function $f(t,x,r,c,\tau)$ (t- time, $dx = dx_1 dx_2 dx_3$- volume element), where the radius of a drop increase from 5 to r+ dr while the age of a seed and the condensation activity on it increase respectively from τ to $\tau + d\tau$ and from c to c+ dc. An equation for this spectrum function, normalized to the drop concentration, is obtained from the law of drop growth by condensation with conservation of mass and energy. This equation is solved analytically, after averaging over turbulent fluxes and subsequent generalization. One specific example considered is steady lateral migration of seeds into a cloud and downward precipitation of drops from it, with diffusion taken into account. The extreme two cases here are very small and very large free-molecule radii with correspondingly high and low values of the condensation coefficient. Vertical turbulence influences the mean radius of drops but not the form of their size distribtuion and the variance. Another specific example considered is a cluster of large drops, where only age and hygroscopicity of

seeds determine the size distribution of drops. Here during lateral mass transfer the wetness of a cloud depends on the velocity of ascending air and the spectrum widens as the condensation coefficient decreases (the free-molecule radius increases), which is characteristic of a nonadiabatic process and a dirty drop surface. Article was presented by Academician I. V. Petryanov-Sokolov on 28 February 1983. References 13: 9 Russian, 4 Western.
[228-2415]

UDC 519.63

METHOD OF SPLITTING FOR SOLUTION OF PROBLEMS IN SEMICONDUCTOR PHYSICS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 274, No 6, Feb 84
(manuscript received 14 Sep 83) pp 1338-1340

BEREZIN, Yu. A. and Academician YANENKO, N. N. (deceased)

[Abstract] The drift-diffusion (hydrodynamic) mathematical model of a semiconductor includes equations of continuity for electrons and holes in addition to the Poisson equation for the electric potential with space-charge density. this model is based on the premise that all parameters of a semiconductor device are functions of the instantaneous electric field intensity. This assumption ceases to be valid as the trend of device miniaturization continues and the kinetic model on the basis of Boltzmann equations for electrons and holes moving in a self-consistent electric field with scattering becomes more appropriate. In an intermediate position is the three-moment model with differential equations of transport derived from the Boltzmann equation of kinetics for the first three moments of the distribution function (density, momentum, temperature) and the collision terms calculated in accordance with the theory of scattering in semiconductors. For mathematical simulation of nonlinear and transient processes, which is now done by analytical and numerical methods based on the fundamental drift and diffusion equations in one-dimensional or two-dimensional formulation, these authors have proposed an efficient implicit finite-difference scheme with fractional steps applicable to a two-dimensional or three-dimensional system of those equations. Assuming constant electron and hole mobilities, constant permittivity of the material, zero generation of electron-hole pairs by impact ionization, and zero recombination, the system of equations is split with respect to the space coordinates as well as with respect to the two physical processes. The algorithm of its solution consists of successive fractional steps, first approxiamtion of transport and diffusion along each coordinate, then adaptation of electron and hole concentrations at selected instants of time, and solving the Poisson equation by any iteration method. The order of approximation in time can be raised by the standard predictor-corrector procedure. Calculations for an MOS transistor with induced n-channel by this method have yielded excellent results. References 7: 3 Russian, 4 Western.
[228-2415]

UDC 541.124/128

SELF-ADJOINT SOLUTION OF EQUATION OF BOUNDARY LAYER FOR CATALYTIC SURFACE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 274, No 6, Dec 84
(manuscript received 14 Nov 83) pp 1321-1325

Academician STRUMINSKIY, V. V., "Mechanics of Nonhomogeneous Media" Sector,
USSR Academy of Sciences, Moscow

[Abstract] The structure of the boundary layer at a catalytic surface is analyzed, assuming that heterogeneous chemical reactions at such a surface proceed at a rate proportional to friction. The validity of this assumption is proved rigorously, for Couette flow between infinitely large plates without edge effect as well as for the vicinity of a stagnation point. The two-dimensional equations of motion and concentration distribution in a boundary layer are solved in accordance with the kinetic theory of gases, considering heterogeneous chemical reactions at the surface as well as homogeneous chemical reactions far from the surface. The former depend on and follow impact of gas molecules directly on the surface with attendant momentum transfer. The latter follow collisions between gas molecules and depend on their concentrations. A new self-adjoint solution of these equations is obtained on this premise, according to which the reagent concentration at the surface is uniform over the area. It reveals new possibilities for improvement of catalytic technological processes. This is demonstrated on conversion of methane with water vapor in a turbular-furnace where a heap of hollow cylindrical stubs of catalytic material provides a large effective catalytic surface. Figure 1, references 5 Russian.
[228-2415]

UDC 531.353.355

ASYMPTOTES TO TRAJECTORY OF CENTER OF MASS OF ROTATING BODY

Alma-Ata IZVESTIYA AKADEMII NAUK KAZAKHSKOY SSR: SERIYA FIZIKO-MATEMATICHESKAYA
in Russian No 1(116), Jan-Feb 84 (manuscript received 22 Apr 83) pp 55-58

MYNBAYEVA, S. M., Alma-Ata Institute of Power Engineering

[Abstract] A body of unit mass is considered rotating in a medium with drag in a constant thrust field, its angular velocity $\omega(t)$ as function of time given and all forces acting on the body applied at its center of mass. The equation for the velocity of the center of mass $dv/dt = b(t) \times v + G - \frac{F(|v|)}{|v|} v$ $(v(0) = v_0$, $v \in R^3$, $t \in R_+$, $b(t) = c_0\omega(t)$, c_0- real coefficient depending on geometry of body and density of ambient medium, $G = (0,0,g)$ - vector of gravitational acceleration, F- nondecreasing continuous function defined on semisxis $R_+ = [0,\infty]$ such that $F(0) = 0$) is analyzed for the nonlinear case. On the basis of an existence and uniqueness theorem for the solution of this equation, stated without proof and bounding the solution on R_+, two theorems are formulated for

asymptotes to the trajectory x(t) of the center of mass. The first theorem, states with proof and followed by two lemmas, applies to $\lim_{t\to\infty} b(t) = b$ and a monotonic function F. The second theorem, stated without proof, applied a continuous b(t) with $\lim_{t\to\infty} b(t) = b$ ($\int_0^\infty |b(\tau) - b| d\tau > \infty$) and $F(r) = cr$ ($c > 0$).

References 9 Russian.
[219-2415]

UDC 533.6.011.72

VELOCITY OF PROPAGATION OF WEAK DISTURBANCES IN WATER WITH STEAM BUBBLES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 273, No 6, Dec 83
(manuscript received 30 Jun 83), pp 1355-1358

KUZNETSOV, N. M., TIMOFEYEV, Ye. I., POLENOV, A. N. and GUBANOV, A. V.,
Institute of Chemical Physics, USSR Academy of Sciences, Moscow

[Abstract] Propagation velocity of weak disturbances in two-phase equilibrium media with low steam content is computed to be low but such low velocities have not been obtained experimentally and shock wave speeds generally coincide with the speed of sound. In order to lower the wave velocity, experiments are down with apparatus to reduce initial steam bubble diameter so that the interphase surface for a unit mass of steam increases and the relaxation time is shortened. Computations based on a theoretical heat transfer and condensation model show that for the reduced bubble dimensions velocity should be reduced but experimental results indicate that in spite of a reduction of bubble diameter by a factor of five a velocity drop of the order of 1 m/s was not obtained. This is linked to the anomalous compressibility of the two-phase system. The mechanisms are discussed in terms of the thermodynamic conditions. Figures 3, references 9: 6 Russian, 3 Western.
[220-12497]

UDC 535.21/621.9.048

METAL DESTRUCTION DURING LASER BREAKDOWN AT LIQUID INTERFACE

Moscow DOKLADY AKADEMII NAUK SSR in Russian Vol 273, No 6, Dec 83
(manuscript received 28 Jun 83) pp 1364-1367

ARUTYUNYAN, P. V., BARANOV, V. Yu., BOL'SHOV, L. A., VELIKHOV, Ye. P.,
ISAKOV, I. M., KOVALEVICH, A. M., LEONOV, A. G., NOVOBRANTSEV, I. V.,
PIS'MENNYY, V. D., SMAKOVSKIY, Yu. B. and STEPANOV, Yu. Yu., Moscow Physicotechnical Institute, Dolgoprudnyy, Moscow Oblast

[Abstract] Metal destruction in liquid media by laser radiation with breakdown near the metal-liquid interface is studied. Computations show that metal fusion beyond the focal spot is possible in immersed breakdown only for pulses

longer than 1 microsecond indicating the interest of comparing fusion characteristics for pulses ranging in length from 10 nanoseconds to 1 microsecond with breakdown energies. Experiments are done with 50 nanosecond and 0.5 microsecond XeCl-laser pulses with energies respectively of 0.2 and 2 J in air and water. Damage was greater in water and fusion traces were found beyond the focal spot area for the longer pulses. Results showed that underwater laser effectiveness increases as breakdown develops at the interface and is determined by vaporization, fusion and plastic deformation which is important in cavity formation in plastic materials with pulses over several tens of nanoseconds. Evacuation of fused material by laser breakdown plasma pressure is significant for microsecond length pulses. Figures 3, references 11: 6 Russian, 5 Western.
[220-12497]

INVESTIGATION OF CRITICAL PHENOMENA IN SYSTEMS WITH TWO COMPETING EXO- AND ENDOTHERMIC REACTIONS. I. THERMAL EXPLOSION

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 1, Jan-Feb 84 (manuscript received 11 Jan 83) pp 55-62

BOROVIKOV, M. B., GOL'DSHLEGER, U. I. and BUROVOY, I. A.

[Abstract] The principles underlying the development of thermal explosion in systems with two competing exo- and endothermic reactions are studied. The temperature of the quasistationary mode for a given degree of conversion is found to be determined by the ratio of the characteristic rates of heat release and heat absorption. Examples of the step kinetics and autocatalytic reactions involved are analyzed to determine which critical phenomena, and in what combination, can be encountered in a given region of the parameters. Figures 6, references 4 Russian.
[276-6900]

INVESTIGATION OF CRITICAL PHENOMENA IN SYSTEMS WITH TWO COMPETING EXO- AND ENDOTHERMIC REACTIONS. II. IDEAL MIXING REACTOR

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 1, Jan-Feb 84 (manuscript received 11 Jan 83) pp 62-65

BOROVIKOV, M. B., GOL'DSHLEGER, U. I. and BUROVOY, I. A.

[Abstract] Changes in transformation modes (quenching, ignition, etc.) are studied, as well as the occurrence of new modes, using the approximation of intense heating and mass exchange within an ideal mixing reactor. Continuous interchange between the reactor and the environment causes quasisteady transformations that can either increase or decrease the degree of transformation of the original reagent. The difference between the transformation modes in an ideal mixing reactor and a closed system is analyzed. The kinetic curves and critical values of Da are analyzed. Figures 3, references 2 Russian.
[276-6900]

LOW TEMPERATURE OXIDATION OF MIXTURE OF TITANIUM WITH CARBON BLACK AND BORON IN AIR

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 1, Jan-Feb 84 (manuscript received 23 Sep 82) pp 43-48

YELIZAROVA, V. A., ROZENBAND, V. I., BABAYTSEV, I. V., GERUSOVA, V. P. and BARZYKIN, V. V.

[Abstract] Low temperature oxidation of a mixture of titanium with carbon black and boron in air preceding ignition is studied by nonisothermal thermography, in which the substance is heated linearly at a given rate. The relationship between the temperature difference between blocks containing the investigated charge and an inert substance, characterizing the heat release of the oxidation reaction, is found as a function of the block temperature t_0. Adding carbon black to titanium instead of boron increases the heat release rate of the oxidation reaction. Data from thermographic and thermogravimetric investigations are presented, indicating that the heat release rate of the boron oxidation reaction exceeds that of carbon. Figures 3, references 5 Russian.
[276-6900]

CONDITIONS FOR SPONTANEOUS ACCELERATION OF THERMAL DECOMPOSITION OF THERMALLY UNSTABLE SOLID SUBSTANCES DURING BRIEF HEATING

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 1, Jan-Feb 84 (manuscript received 24 Jun 82; revised 17 Jan 83) pp 40-43

SHLENSKIY, O. F. and AFANAS'YEV, N. V.

[Abstract] Conditions supporting spontaneous combustion of solid materials are examined. It is found that when a substance is heated rapidly to a minimum critical temperature a spontaneously accelerating rise in the temperature occurs. In addition to reaching the critical temperature, it is also necessary for the applied heat to be brief enough for the chemical phase transmission mechanism to be implemented. The behavior of the kinetic processes occurring is analyzed, and the minimum thermal exposure time for exciting the chemical-phase spontaneous mechanism is determined. Figure 1, references 10 Russian.
[276-6900]

INFLUENCE OF HEAT LOSSES ON STATIONARY WAVE PROPAGATION DURING FILTRATION COMBUSTION OF GASES

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 1, Jan-Feb 84
(manuscript received 30 Nov 82; revised 8 Feb 83) pp 19-26

POTYTNYAKOV, S. I., LAYEVSKIY, Yu. M. and BABKIN, V. S.

[Abstract] The wave propagation conditions for filtration gas combustion in the presence of heat loss are examined theoretically and experimentally. Combustion wave propagation limits are demonstrated to exist in the low speed propagation mode. An equation is derived for determining the critical parameters. The behavior of the velocity of a filtration combustion wave is found to be determined by the kinetic and thermophysical properties of the reagent phase, the thermophysical properties of the inert porous medium, and also the gas filtration rate. The theoretical and experimental findings agree satisfactorily. Figures 7, references 4: 3 Russian, 1 Western.
[276-6900]

UDC 532.542:624.139

THERMAL INTERACTION BETWEEN PIPELINE AND SURROUNDING FROZEN GROUND

Minsk INZHENERGO-FIZICHESKIY ZHURNAL in Russian Vol 46, No 2, Feb 84
(manuscript received 5 Oct 82) pp 209-216

BREKHMAN, I. Ya. and KRASOVITSKIY, B. A., All-Union Scientific Research and Planning Institute for Transportation Progress

[Abstract] The thermal interaction occurring when a pipeline is buried in finely dispersed frozen soil is analyzed. The ground in which the pipeline lies is assumed to be frozen when the pipeline is started up. The influence of surface snow cover is disregarded. The temperature of the liqud in the pipeline is assumed to be constant and positive. An algorithm is proposed for solving the problem numerically and applied to the three dimensional problem. The results of the proposed method are compared with existing solutions of the Stefan problem. References 13 Russian.
[305-6900]

UDC 533.6.011.8

INVESTIGATION OF HEAT AND MASS TRANSFER ON SPHERICAL DROPLETS UNDER CHANGING ENVIRONMENTAL CONDITIONS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 3, Mar 84
(manuscript received 8 Jun 83) pp 595-599

IVCHENKO, I. N., Moscow Economics-Statistical Institute

[Abstract] The temporal behavior of droplets is investigated by menas of an expression for the evaporation rate of single droplets. An investigation is

performed under conditions of heat and mass exchange with an environment whose parameters vary over time due to change in the vapor concentration in the medium caused by evaporation or condensation of vapor on the droplet, as well as change in the temperature of the medium caused by the release of phase transition heat. The theoretical and experimental findings agree satisfactorily. Figures 2, references 6: 3 Russian, 3 Western.
[270-6900]

UDC 621.373.826+536.2

THERMODIFFUSION SEPARATION OF WORKING GASES IN He-Ne GAS DISCHARGE TUBES

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVADENIY: FIZIKA in Russian Vol 27, No 3, Mar 84 (manuscript received 27 Apr 83) pp 117-118

GOLUBENTSEV, A. F., GOL'DMAN, S. Yu. and RABINOVICH, E. M., Saratov State University imeni N. G. Chernyshevskiy

[Abstract] The presence of a radial temperature gradient in a cylindrical gas discharge tube, which is usually significantly greater than the longitudinal gradient, produces transverse separation of the gas mixture and changes the He and Ne concentrations along the radius. The radial coefficient of separation of the gas mixture in an He-Ne laser is calculated. Significant separation of gases is observed with the He-Ne gas discharge tube in the vertical position, where the convective and thermodiffusion effects result in significant separation of the mixture components along the discharge tube. References 10: 9 Russian, 1 Western.
[272-6900]

UDC 536.244

CHARACTERISTICS OF TRANSIENT HEAT EXCHANGE PROCESS IN TURBULENT FLOW OF DISSOCIATING COOLANT IN PIPE WITH SUPERCRITICAL PARAMETERS DURING INSTANTANEOUS CHANGE IN HEAT RELEASE IN PIPE WALL

Minsk VESTSI AKADEMII NAVUK BSSR: SERIYYA FIZIKA-ENERHETYCHNYKH NAVUK in Russian No 2, Apr-Jun 84 (manuscript received 30 Sep 83) pp 61-65

DEVOYNO, A. N. and CHERNOUSOV, S. V., Institute of Nuclear Power Engineering Belorussian SSR Academy of Sciences

[Abstract] Nonstationary heat exchange during turbulent flow of a chemically reactive N_2O_4 coolant in a round pipe is examined experimentally in order to obtain the nonstationary heat release coefficients. A two-point power supply scheme is employed in the experimental setup. The behavior of the temperatures and thermal flux on the inner surface of the walls are analyzed. As the thermal load increases, increasing amounts of heat are found to be consumed in dissociation of N_2O_4 and O_2 molecules, which retards temperature increases in the wall and the coolant. Figures 3, references 5 Russian.
[298-6900]

UDC 536.242:532.529.5

METHOD FOR CALCULATING TEMPERATURE PROFILES IN TWO-PHASE ANNULAR FLOWS

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 46, No 4, Apr 84
(manuscript received 31 Dec 82) pp 666-670

CHEPURNOY, M. N. and SHNAYDER, V. E., VINNITSA Polytechnical Institute

[Abstract] An analytical method is proposed for measuring local temperatures in the cross section of a thin liquid film. An example is presented of the calculated temperature profiles in a water film moving in a pipe 30 mm in diameter along with a stream of air. The thickness of the boundary layer in the film next to the wall, where the temperature distribution is linear, is shown to be small, and to drop as the Reynolds number of the film increases. Figure 1, references 6 Russian.
[290-6900]

UDC 536.468

CONDITIONS FOR STABLE IGNITION OF SOLID FUELS

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 48, No 4, Apr 84
(manuscript received 15 Dec 82) pp 65[illegible]-659

SERGEYEV, G. T., Institute of Heat- and Mass-Exchange imeni A. V. Lykov, Belorussian SSR Academy of Sciences

[Abstract] The conditions for ignition of wood-based materials are examined with respect to interaction with the boundary layer. An equation is derived for the heat conductance of a fuel layer of a given thickness. Ignition criteria are derived and interpreted physically. The analytical findings are tested experimentally in order to identify the phase and chemical changes occurring in solid fuel due to the evaporation of moisture and thermal decomposition. References 10: 1 Russian, 9 Western.
[290-6900]

UDC 536.3:536.25

HEAT TRANSFER OF VERTICAL BUNDLE OF HEAT RELEASING RODS IN ABSENCE OF COOLANT CIRCULATION

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 46, No 4, Apr 84
(manuscript received 30 Dec 82) pp 549-554

GOTOVSKIY, M. A., FEDOROVICH, Ye. D., Fromzel', V. N. and SHLEYFER, V. A. Scientific Production Association for the Investigation and Design of Power Engine Equipment imeni I. I. Polzunov, Leningrad

[Abstract] A method is presented for calculating conductive-radiative heat exchange in bundles of heat releasing rods arranged vertically in a jacket in

order to solve problems associated with the storage and transporation of spent groups of reactor fuel elements. The radiant and conductive heat flux components are analyzed. It is found that allowance can be made for free convection by using the effective thermal conductivity. The findings can be used to construct an analytical model for determining the temperature field in bundles of heat release rods when the influence of natural convection is significant. Figures 4, references 6 Russian.
[290-6900]

UDC 536.423.1

EXPERIMENTAL INVESTIGATION OF INTENSITY OF HEAT EXCHANGE DURING EVAPORATION OF COOLANT FROM CORRUGATED CAPILLARY STRUCTURE

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 46, No 4, Apr 84
(manuscript received 21 Jan 83) pp 533-538

IVANOVSKIY, M. N., PRIVESENTSEV, V. V., IL'IN, YU. A. and SIDORENKO, Ye. M.

[Abstract] Findings from experimental investigation of heat exchange on a surface with a porous capillary coating prepared by corrugating a nickel mesh are presented. The experiments were performed on a setup designed for investigating heat exchange processes during evaporation of liquid on the surface of experimental specimens. The thermal flux density is investigated as a function of the differential in the wall-vapor temperatures. A model is proposed for the heat exchange process to explain the findings. A thin mesh placed between the wall and corrugated structure improves the heat transfer rate by 30-40%. Figures 3, references 7: 6 Russian, 1 Western.
[290-6900]

UDC 536.24.01

COOLING OF SEMIINFINITE BODY WITH NONLINEAR SURFACE HEAT RELEASE

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 45, No 4, Oct 83
(manuscript received 11 May 82) pp 633-635

BABENKO, Yu. I.

[Abstract] A simple method for solving problems with nonlinear boundary conditions is presented for the case in which the temperature field need not be defined, which makes it possible to obtain asymptotic cooling over extended periods. Formulas are derived to describe the surface temperature variation for short and long durations. References 3: 2 Russian, 1 Western.
[312-6900]

UDC 519.21

WAITING TIME VARIANCE RATIO FOR SYSTEMS WITH DIFFERENT SERVICE DISCIPLINE RESTRICTIONS

Tashkent IZVESTIYA AKADEMII NAUK UzSSR: SERIYA FIZIKO-MATEMATICHESKIKH NAUK in Russian No 1, Jan-Feb 84 (manuscript received 29 Jan 82) pp 3-7

AZLAROV, T. A. and TAIROV, Sh., Institute of Mathematics imeni V. I. Romanovskiy, UzSSR Academy of Sciences, Karshi Affiliate, Tashkent Engineering Institute of Irrigation and Mechanization of Agriculture

[Abstract] Studies of queuing systems show that service time variance is minimum for service in order of arrival and maximum for service in reverse order of arrival but that average waiting time does not depend upon service disciplines and use the premise that service disciplines do not affect the distribution of the number of customers in line at any moment. The present paper studies an M/M/m/n system. The waiting time variance for the ratio of disciplines with service in order of arrival service in reverse order of arrival is found to be asymptotic when the number of customers increases infinitely and the utilization load of the system approaches the critical value. A set of theorems is proven describing system behavior. References 3 Western.
[241-12497]

UDC 519

ESTIMATTION OF TYPE OF MAXIMUM LIKELIHOOD FOR NONPARAMETRIC REGRESSION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 273, No 6, Dec 83 (manuscript received 10 Mar 83) pp 1310-1314

NEMIROVSKIY, A. S., POLYAK, B. T. and TSYBAKOV, A. B., Institute of Data Transmission Problems, USSR Academy of Sciences, Moscow

[Abstract] An improved likelihood method for random values is presented for nonparametric regression that has the advantage of being uniform for parametric and nonparametric cases and can compute a priori data for the random value distribution law while the statistical characteristics of the estimate are not worse than for linear estimates and estimates for many classes of functions

are spline. Problems involved in practical applications involve the setting of constants for functions and a large volume of computations but the method can be generalized to solution of nonparametric problems such as the establishment of density distribution, solution of integral equations with second member fixed at a finite point in the presence of random errors and establishment of functions when other functions are known for the point.
[220-12497]

UDC 62-501.4:62-503.25

EQUIVALENT FEEDBACK IN LINEAR STATIONARY CONTROL SYSTEMS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 2, Feb 84 (manuscript received 22 Mar 82) pp 54-65

YAKUBOVICH, V. A. and YAKUBOVICH, Ye. D.

[Abstract] Various optimization problems concerning analytic regulator theory and the minimization of dispersion due to white noise, stationary disturbances, control problems, etc., involve the establishment of feedback mechanisms. In practice, it is difficult to measure all the components of the state vector upon which the regulation device is to be based and it is necessary to replace the original feedback system by an equivalent system relating to a certain scalar output variable. The question arises as to the existence of the equivalent feedback solution. The application of the Wiener factorization method for input-output variables and the generation of optimal linear regulator solutions suggests that, in the general case, equivalent feedbacks do exist. However they are not always possible and the study establishes sufficient and necessary criteria for their existence and examples of the application of the method are given. Figure 1, references 5 Russian.
[240-12497]

UDC 62-505

OPTIMAL CONTROL WITH MULTIPLE CRITERIA

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 2, Feb 84 (manuscript received 24 May 82) pp 27-32

VINOGRADSKAYA, T. M., MAKAROV, I. M., RUBCHINSKIY, A. A., SOKOLOV, V. B. and SHCHERBAKOV, A. V.

[Abstract] Several criteria must be taken into account simultaneously in the solution of applied problems such as spacecraft design where payload is to be maximized for a minimum time for minimal fuel expenditure or economic planning where sector outputs are maximized in minimal times under resource constraint conditions. Special theoretical constructs are developed for these problems

and control equations are generated. The present paper describes the optimization principle by a binary function or by utility functions. The concept of R-optimality is introduced for broad classes of R relations. For cases in which the optimization principle takes the form of a prior unknown utility functions, an iterative procedure is introduced that produces an optimal control solution on the basis of limited information. An exmaple is discussed consisting of a three-sector economic system in which one sector generates funds to be optimally used by the other two. References 4 Russian.
[240-12497]

UDC 517.956.6

SOLVABILITY OF MIXED PROBLEM FOR NONLINEAR SCHROEDINGER-TYPE EQUATION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 4, Apr 84
(manuscript received 8 Dec 83) pp 780-783

VLADIMIROV, M. V., Scientific Research Computer Center, Moscow State University imeni M. V. Lomonosov

[Abstract] The problem of the existence and uniqueness of a generalized solution of a mixed problem for a nonlinear Schroedinger-type equation with specified boundary and initial conditions is examined. The equation is shown to be solvable on the whole for $0 \leqslant p \leqslant q$, $\beta > 0$, and any real α. The solution is found to be unique for $p=2$, $q \geqslant 0$, $\beta \geqslant 0$. The existence of the solution to the problem is proved by Galerkin's method. References 6: 5 Russian, 1 Western.
[285-6900]

UDC 518.5

AUTOMATIC COMPUTER CONSTRUCTION AND INVESTIGATION OF DIFFERENCE SCHEMES IN ANALYTICAL FORM

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 275, No 3, Mar 84
(manuscript received 29 Jul 83) pp 528-532

VALIULLIN, A. N., GANZHA, V. G., IL'IN, V. P., SHAPEYEV, V. P. and academician YANENKO, N. N., Institute of Theoretical and Applied Mechanics, Siberian Department, USSR Academy of Sciences, Novosibirsk

[Abstract] A unified formalized algorithm is developed for the undefined coefficient method in order to approximate the various differential equations on different grid templates with arbitrary ordering; the algorithm is implemented by computer with the help of symbolic operations. An example is presented for the Dirichlet problem for the Poisson equation of a new monotonic fourth-order difference approximation. A numerical experiment to check the difference equations obtained is described. A package of programs is described that automates a number of algorithms. Figures 4, references 9: 6 Russian, 3 Western.
[270-6900]

UDC 531.8

SOLUTION OF MULTICRITERIAL PROBLEMS OF OPTIMAL MACHINE AND MECHANISM DESIGN

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR: SERIYA A, FIZIKO-MATEMATICHESKIYE I TEKHNICHESKIYE NAUKI in Russian No 4, Apr 84 (manuscript received 14 Feb 83) pp 68-72

CHERVONENKO, A. G. and GRIGORENKO, G. I., Institute of Geotechnical Mechanics, Ukrainian SSR Academy of Sciences

[Abstract] A new approach is reported for solving multicriterial optimal machinery design problems in which a Pareto set of optimal models of the machine is first constructed by isolating effective solutions during global sounding of the parameter space by multidimensional Sobol' points uniformly filling that space. This is followed by identifying a compromise optimal model of the machine with the participation of the decision maker. A numerical algorithm for global sounding of the parameter space is presented. The method is demonstrated using the example of selecting optimum parameters for a vibration conveyor for carrying minerals from a mine. References 6 Russian.
[301-6900]

UDC 517.946

NORMALIZED EIGENFUNCTIONS OF TWO-POINT NONLINEAR BOUNDARY VALUE PROBLEM

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR: SERIYA A, FIZIKO-MATEMATICHESKIYE I TECHNICHESKIY NAUKI in Russian No 4, Apr 84 (manuscript received 22 Jul 83) pp 4-8

DYMARSKIY, Ya. M., Voroshilovgrad Pedagogical Institute imeni T. G. Shevchento

[Abstract] The author considers a nonlinear boundary value problem with eigenvalues $u''+\lambda A(x, u, u')u+ B(x, u, u')=0$, $u(0)=u(\pi)=0$, where λ is a real number, and the functions $A(x, y, z)$ and $B(x, y, z)$ are defined on the set $[0, \pi] \times R^1 \times R^2$ and are continuous with respect to the set of arguments in the entire domain of definition. Two theorems, one concerning the existence of two countable sequences of solutions and the other concerning a prior estimates, are formulated and proved. References 2 Russian.
[301-6900]

UDC 517.934

SOLUTION OF NONLINEAR PROBLEMS

Moscow ZHURNAL VYCHISLITEL'NOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian
Vol 24, No 4, Apr 84 (manuscript received 6 May 82; revised 24 Oct 83)
pp 612-615

BANDURIN, N. G. and NIKOLAYEV, A. P.

[Abstract] A step method is proposed for solving systems of nonlinear equations for unknown functions depending upon a single parameter in which the increment vector of the sought functions is computed in each step from linear algebraic equations derived by expanding the first member of the original system in a Taylor series and retaining the discrepancy vectors. The Cauchy problem is solved for a system of ordinary nonlinear integrodifferential equations by solving a system of linear equations for the highest-order derivatives in each step. The system of partial integrodifferential equations is solved as a Cauchy problem for the system of ordinary integodifferential equations derived from the system in question by discretizing it with respect to all arguments except for one, which is used as a parameter. Figure 1, references 2 Western.
[292-6900]

UDC 519.7

RECOGNITION BY LOCALIZABLE FUNCTION METHOD

Moscow ZHURNAL VYCHISLITEL'NOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian
Vol 24, No 4, Apr 84 (manuscript received 8 Jun 82) pp 587-598

YAKOVLEV, S. A.

[Abstract] A Neumann-Pearson decision making scheme is examined for the class of determinant optimal decision rules based on the sign of a given function. The properties of localizable functions are investigated. A formal description of the proposed scheme is provided, and estimates of the recognition error are derived. A localization theorem is stated and proved, and probabilistic passage to the limit is investigated. References 6 Russian.
[292-6900]

UDC 519.624

SOME MODIFICATIONS OF SHOOTING METHOD FOR SOLVING NONLINEAR TWO-POINT BOUNDARY VALUE PROBLEMS

Moscow ZHURNAL VYCHISLITEL'NOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian
Vol 24, No 4, Apr 84 (manuscript received 20 May 82; revised 7 Dec 82)
pp 504-513

GAYDUK, V. F.

[Abstract] Modifications are proposed for the shooting method employed for solving boundary value problems for ordinary difference equations in which the

shooting is structured so that the requirements that the Cauchy problem be solvable over the entire integration segment [0,t] can be relaxed. It is shown that a converging shooting process can be constructed by computing the shooting trajectories until they are all contained in some set within which the boundary value problem is solvable. A method for sequential organization of shooting is described in which the solution of the boundary value problem is sought sequentially. The method is illustrated by solving a test problem and calculating the stressed state of a flexible rod. Figures 2, references 12: 9 Russian, 3 Western.
[292-6900]

UDC 517.9

ASYMPTOTIC DECOMPOSITION OF SYSTEMS OF ORDINARY NONLINEAR DIFFERENTIAL EQUATIONS

Kiev UKRAINSKIY MATEMATICHESKIY ZHURNAL in Russian Vol 36, No 1, Jan-Feb 84 (manuscript received 15 Jun 83) pp 35-45

MITROPOL'SKIY, Yu. A. and LOPATIN, A. K., Institute of Mathematics, UkSSR Academy of Sciences, Kiev

[Abstract] G. Hori's theory of general perturbations with unspecified canonical variables which was the first to use Lie series for the substitution of variables is employed here to extend the averaging technique of N. N. Bogolyubov to the derivation of an asymptotic decomposition algorithm for systems of nonlinear ordinary differential equations. The algebra of the centralizer β_0^k of the perturbed system is constructed and the conditions for the separation of variables in the transformed system of the centralizer into fast and slow variables are established. The conditions for the decomposability of this system into smaller subsystems in any approximation are also ascertained. In substantiating the proposed algorithm, a transition was made from a Jacobi system to a system of linear ordinary differential equations, which requires knowledge of the general solution and the first integrals of the zero zpproximation system. For systems with polynomial coefficients, the corresponding Jacobi systems can be solved directly without transition to ordinary differential equations, and the elements of the centralizer algebra and operators of the reducing transform can be found without knowing the general solution or the first integrals. The algorithm derived here, in contrast to the averaging method of N. N. Bogolyubov and the variants of it for systems of differential equations with fast and slow variables, does not require the reduction of the system being studied to standard form. As opposed to that asymptotic method, no explicit form of the solution of the zero order approximation system is used; only the structural properties of the enveloping Lie algebra of the zero order approximation system and the initial system are employed. The algebra of the centralizer is thus equivalent to a generalization of an averaging operator. References 14: 8 Russian, 5 Western.
[230-8225]

UDC 681.518

EXECUTION OF LINEAR ALGEBRA ALGORITHMS IN PARALLEL USING MODULAR CODING PRINCIPLES

Alma-Ata VESTNIK AKADEMII NAUK KAZAKHSKOY SSR in Russian No 3, Mar 84 pp 33-39

AMERBAYEV, V. M., corresponding member of KaSSR Academy of Sciences, PAK, I. T., candidate of technical sciences

[Abstract] While the major operations of linear algebra (scalar multiplication of vectors, multiplication of matrices by a vector, multiplication of a matrix by a matrix) represent a class of procedures most efficiently handled in a gaussian arithmetic, computations involving large vector and matrix systems require not only copious calculations, but also accurate accounting for the error accumulation processes. In case of inadequate computer capacity, the accuracy of the computed value of a scalar product can be in doubt; the only way of enhancing the precision is then increasing computer capacity and correspondingly reducing the cumulative error in the initial data. This paper is a detailed theoretical treatment of calculations on a ring of a complete system of PCZ residues. The concept of an arithmetic expression in an alphabet $A = CZ_p \cup \cap 0$ is introduced; the variables and constants are arithmetic expressions and the simple operations of addition, subtraction, multiplication and division of these expressions are also arithmetic expressions. Matrix schemes for modular vector calculations on CZ_p are presented. A theorem demonstrating the solvability of CZ_p systems using a gaussian algorithm is stated and proved. Conditions are defined under which computations in modular arithmetic, representing calculations in a ring of integer gaussian numbers or with any limitations on the computation in a gaussian number ring, can be interpreted in residue ring language without losing computational precision. The question of matching the dynamic and machine ranges for computations of this type is analyzed for the case of a fixed decimal point mode as the most acceptable for modular arithmetic. Modular arithmetic is the most efficient in solving high order systems using iteration methods. Each iteration cycle requires $2n^2$ modular operations and is concluded with a comparison of the values from rounding-off operations. The overall number of rounding operations is 2nm, where m is the number of iterations needed to obtain a solution of the requisite accuracy. References 3 Russian.
[239-8225]

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